

# **WSDOT MITIGATION SITES**

## **NORTHWEST REGION**

### **2003 MONITORING REPORT**

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## Northwest Region 2003 Annual Monitoring Report



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## Executive Summary

The following tables summarize performance criteria and results obtained in 2003.

### King County Sites

| Site Name                         | Performance Criteria   | 2003 Results                           |
|-----------------------------------|--|--|
| <b>SR 18 Frog Pond (Year 5/5)</b> |  |  |
|                                   | 80% cover of woody species in the wetland  | 64% (CI <sub>90%</sub> = 54-73% cover) |
|                                   | 80% cover of woody species on the site   | 64% (CI <sub>95%</sub> = 57-70% cover) |
|                                   | > 75% cover by planted or native woody species in the upland and riparian buffer | 64% (CI <sub>90%</sub> = 57-70% cover) |
|                                   | Difference in height between shrubs and trees                                    | Present                                |

|  |   |  |
|--|---|--|
| <b>SR 18 Holder Creek 1 (Year 5/5)</b> |   |  |
|  | 80% cover of woody species on the site                                | 40% (CI <sub>90%</sub> = 35-45% cover) |
|  | 80% cover of woody species in the wetland                             | 4% (CI <sub>80%</sub> = 3-5% cover)    |
|  | ≥ 75% cover by native woody species in the upland and riparian buffer | 45% (CI <sub>80%</sub> = 38-52% cover) |
|  | Difference in height between shrubs and trees                         | None observed                          |

|  |                                 |                                      |
|--|---------------------------------|--------------------------------------|
| <b>SR 18 Holder Creek 2 (Year 2/5)</b> |                                 |                                      |
|  | < 10% non-native invasive cover | 1-2% aerial cover                    |
|  | > 10% shrub cover               | 7% (CI <sub>80%</sub> = 5-10% cover) |

|                                  |   |  |
|----------------------------------|---|--|
| <b>SR 18 Kendal 1 (Year 6/8)</b> |   |  |
|                                  | 80% woody cover in the wetland                | 40% (CI <sub>80%</sub> = 35-46% cover) |
|                                  | ≥ 75% woody cover in the buffer               | 37% (CI <sub>80%</sub> = 31-43% cover) |
|                                  | 80% woody cover on the entire site            | 39% (CI <sub>80%</sub> = 35-43% cover) |
|                                  | Difference in height between shrubs and trees | Present                                |

|                                       |   |                                     |
|---------------------------------------|---|-------------------------------------|
| <b>SR 164 Bass Lake 2 (Year 1/10)</b> |   |                                     |
|                                       | Wetland hydrology   | Inundated in April                  |
|                                       | 100% survival at end of first growing season                    | 84% (total count) <sup>1</sup>      |
|                                       | < 10% cover by King Co. Class A, B-designate and priority weeds | 6% (CI <sub>80%</sub> = 3-8% cover) |

|   |   |  |
|---|---|--|
| <b>SR 167 Mill Creek Stage 2 (Year 5/5)</b> |   |  |
|   | 25% woody cover in wetland dominated by wetland species | 22% (CI <sub>80%</sub> = 18-26% cover) |
|   | 90% of woody vegetation native                          | 100% native species                    |
|   | 25% native woody cover in buffer                        | 20% (CI <sub>80%</sub> = 16-24% cover) |
|   | 25% woody cover in wetland enhancement area             | < 1% aerial cover                      |
|   | < 10% aerial cover by reed canarygrass                  | 68% (CI <sub>90%</sub> = 60-76% cover) |

<sup>1</sup> Replanting of woody species is planned for the winter 2003-04 planting season. This replanting is intended to satisfy a contingency stated in the mitigation plan (WSDOT 2003).

| Site Name                             | Performance Criteria  | 2003 Results                   |
|---------------------------------------|---|--------------------------------|
| <b>SR 169 Bass Lake 1</b> (Year 1/10) |   |                                |
|                                       | Wetland hydrology on 0.731 acres                                | Inundation observed in April   |
|                                       | 100% survival at end of first growing season                    | 84% (total count) <sup>2</sup> |
|                                       | < 10% cover by King Co. Class A, B-designate and priority weeds | None observed                  |

|   |   |  |
|---|---|--|
| <b>SR 202 Rutherford Creek</b> (Year 1/5) |   |  |
|   | 100% survival of planted woody species                                | 91% survival (total count)             |
|   | 60% cover of native, FAC and wetter herbaceous species in the wetland | 35% (CI <sub>80%</sub> = 28-42% cover) |

|   |   |                            |
|---|---|----------------------------|
| <b>SR 203 Stillwater Hill Road</b> (Year 2/3) |   |                            |
|   | ≥ 80% survival of planted woody species | 83% survival (total count) |

### Snohomish County Sites

| Site Name                      | Performance Criteria                            | 2003 Results                    |
|--------------------------------|---|---------------------------------|
| <b>SR 5 Ash Way</b> (Year 5/5) |   |                                 |
|                                | Create 0.51 acres of wetland                    | 0.46 acres (delineated in 2002) |
|                                | Create 0.43 acres of buffer                     | 0.48 acres (delineated in 2002) |
|                                | Food chain support                              | Yes                             |
|                                | Sediment and nutrient trapping                  | No                              |
|                                | Water storage capacity                          | Intermittent                    |
|                                | Increase in wildlife habitat diversity          | Yes                             |
|                                | ≥ 27 habitat structures present                 | Yes                             |
|                                | Shrubs will provide food for avians and mammals | Yes                             |

|  |   |                                    |
|--|---|------------------------------------|
| <b>SR 5 Stanwood/Bryant</b> (Year 3/5) |   |                                    |
|  | Maintain a weed-free condition to ensure continued growth | Woody species are well established |

|                                     |  |  |
|-------------------------------------|--|--|
| <b>SR 9 Howell Creek</b> (Year 5/5) |  |  |
|                                     | ≥ 50% cover of woody species in the forested and scrub-shrub wetland | 80% (CI <sub>90%</sub> = 74-86% cover)   |
|                                     | ≥ 80% FAC and wetter herbaceous species in the emergent wetland      | 93% (CI <sub>90%</sub> = 88-98% cover)   |
|                                     | < 15% cover of non-native species in the wetland                     | Forested/scrub-shrub invasives:<br>20% (CI <sub>80%</sub> = 16-25% cover)<br>Emergent invasives:<br>57% (CI <sub>80%</sub> = 48-65% cover) |
|                                     | Presence of scrub-shrub and forested classes                         | Present  |
|                                     | In-stream habitat structures will remain in place                    | 9 of 16 habitat structures were observed   |
|                                     | Juvenile rearing and overwintering habitat                           | Not functioning as intended  |

<sup>2</sup> Replacement planting is planned for the winter 2003-04 planting season.

| Site Name                            | Performance Criteria  | 2003 Results                                |
|--------------------------------------|---|---|
| <b>SR 99 Lincoln Way (Year 3/10)</b> |   |   |
|                                      | 70% relative aerial cover of native FACW and wetter herbaceous vegetation in the emergent zone      | 70% (CI <sub>80%</sub> = 61-79% cover)      |
|                                      | 15% aerial cover by native FAC and wetter woody vegetation in the scrub-shrub and forested wetlands | 12% (CI <sub>80%</sub> = 10-14% cover)      |
|                                      | 15% aerial cover by native woody species in the buffer  |   |
|                                      | < 10% aerial cover by invasive exotic species   | 1% (CI <sub>80%</sub> = 0-1% cover)         |
|                                      | Wetland hydrology   | Observed                                    |
|                                      | Habitat structures  | Observed                                    |
|                                      | Increase in wildlife cover and forage species for habitat structure                                 | Dense vegetation and seasonal ponds present |
|                                      | Inspect wetland for stranded fish   | None observed                               |

|                                    |   |   |
|------------------------------------|---|---|
| <b>SR 99 Manor Way (Year 3/10)</b> |   |   |
|                                    | 70% relative aerial cover of native FACW and wetter herbaceous vegetation in the emergent zone      | 37% (CI <sub>80%</sub> = 30-44% cover)      |
|                                    | 15% aerial cover by native FAC and wetter woody vegetation in the scrub-shrub and forested wetlands | 22% (CI <sub>80%</sub> = 16-27% cover)      |
|                                    | 15% aerial cover by native woody species in the buffer  | 29% (CI <sub>80%</sub> = 21-37% cover)      |
|                                    | < 10% aerial cover by invasive exotic species   | 4% (CI <sub>80%</sub> = 2-6% cover)         |
|                                    | Wetland hydrology   | Present                                     |
|                                    | Habitat structures  | Present                                     |
|                                    | Increase in wildlife cover and forage species for habitat structure                                 | Dense vegetation and seasonal ponds present |
|                                    | Inspect wetland for stranded fish   | None observed                               |

## List of Acronyms

| Acronym | Meaning  |
|---------|--|
| CI      | Confidence Interval (see Methods and Glossary)   |
| ECY     | Washington State Department of Ecology           |
| FAC     | Facultative Indicator Status (Reed 1988)         |
| FACW    | Facultative Wetland Indicator Status (Reed 1988) |
| IP      | Individual Permit                                |
| MP      | Mile Post  |
| NWP     | Nationwide Permit                                |
| OBL     | Obligate Wetland Indicator Status (Reed 1988)    |
| SR      | State Route                                      |
| USACE   | United States Army Corps of Engineers            |
| WDFW    | Washington Department of Fish and Wildlife       |
| WSDOF   | Washington Department of Fisheries               |
| WSDOT   | Washington State Department of Transportation    |



# Introduction

## History

Infrastructure improvements including highway construction projects, highway interchanges, and bridges have accompanied economic and population growth in the state of Washington. The Washington State Department of Transportation (WSDOT) routinely evaluates the potential for degradation of critical areas that result from these infrastructure improvements. WSDOT strictly complies with applicable federal, state, and local environmental regulations, including the Clean Water Act and the state “no net loss” policy for wetlands (Executive Order 89-10). Generally, mitigation sites are planned when transportation improvement projects adversely affect critical areas. The WSDOT Wetland Assessment and Monitoring Program monitors these mitigation sites as a means of evaluating compliance with permit conditions and tracking overall development. Sixty-three sites statewide were monitored in 2003. Of the 26 sites included in this year's Annual Monitoring reports, 21 have standards to be addressed in 2003, and five are provided as a requested courtesy.

## Purpose

The purpose of this document is to report the status of WSDOT Northwest Region mitigation sites with respect to permit compliance and success standards for 2003 (Map 1).<sup>3</sup> We rely on feedback from the users of this report to ensure its contents are clear, concise, and meaningful.

## Process

Monitoring typically begins the first spring after a site is planted and continues for the time period designated by the permit or mitigation plan. The monitoring period generally ranges from three to ten years. In special cases sites may be monitored beyond the designated period.

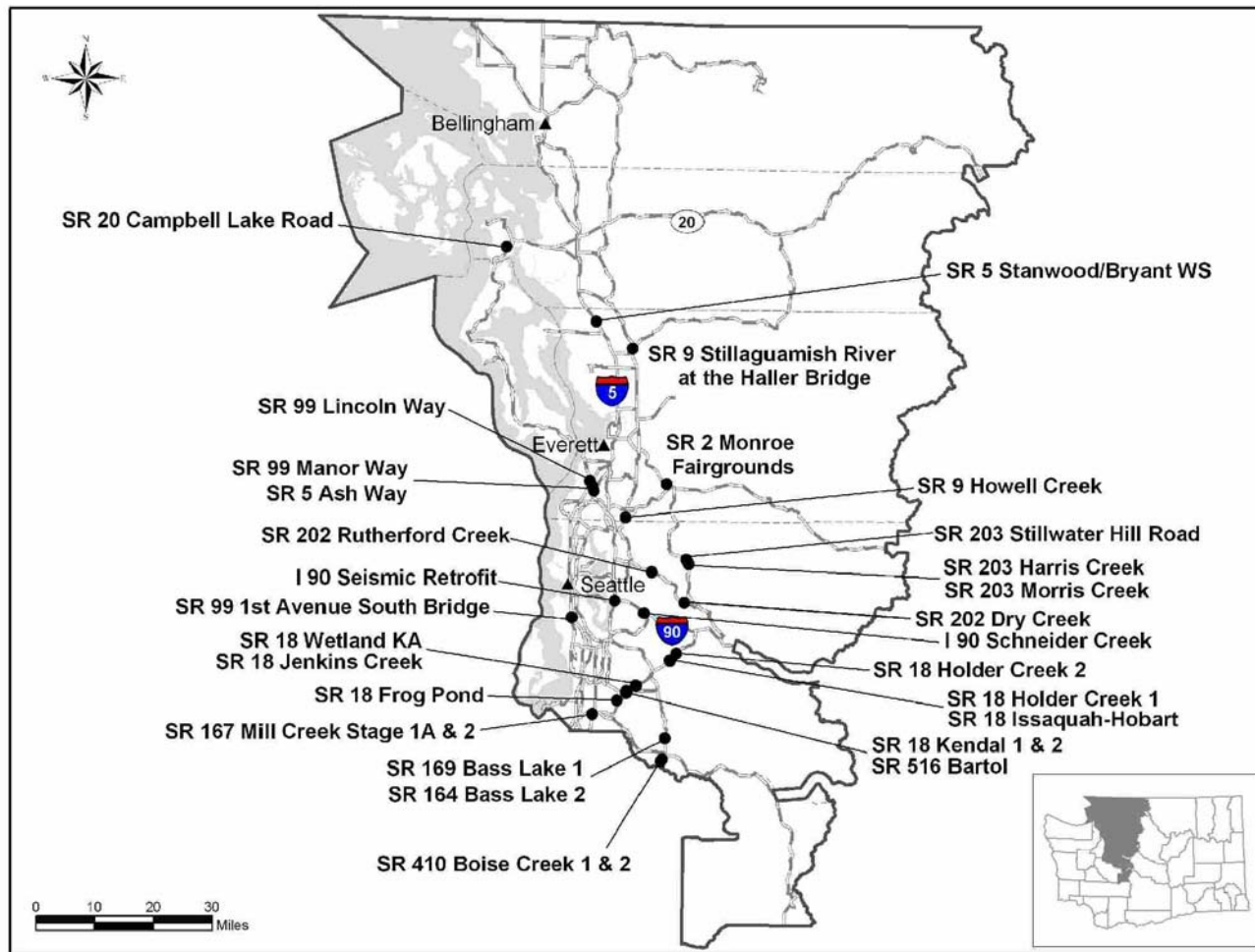
Monitoring activities are driven by site-specific success standards detailed in the mitigation plan or permits. Data are collected on a variety of environmental parameters including vegetation, soils, hydrology, and wildlife. When data analysis is complete, information on site development is communicated to region staff to facilitate management activities as part of an adaptive management process. Monitoring reports are issued to regulatory agencies and published on the web at:

[www.wsdot.wa.gov/environment/wetmon/default.htm](http://www.wsdot.wa.gov/environment/wetmon/default.htm)

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<sup>3</sup> Sites shown on the map without reports were evaluated for internal feedback only. A report is issued only for sites with success standards that apply to the current year.

**Map 1: Northwest Region Sites Monitored in 2003**



## Methods

Methods used for monitoring mitigation sites change as site requirements and customer needs evolve. Quantitative data collection techniques presently in use are based on standard ecological and biostatistical methods.<sup>4</sup> The Wetland Program's current monitoring methods include the following key elements:

### Objective-based Monitoring

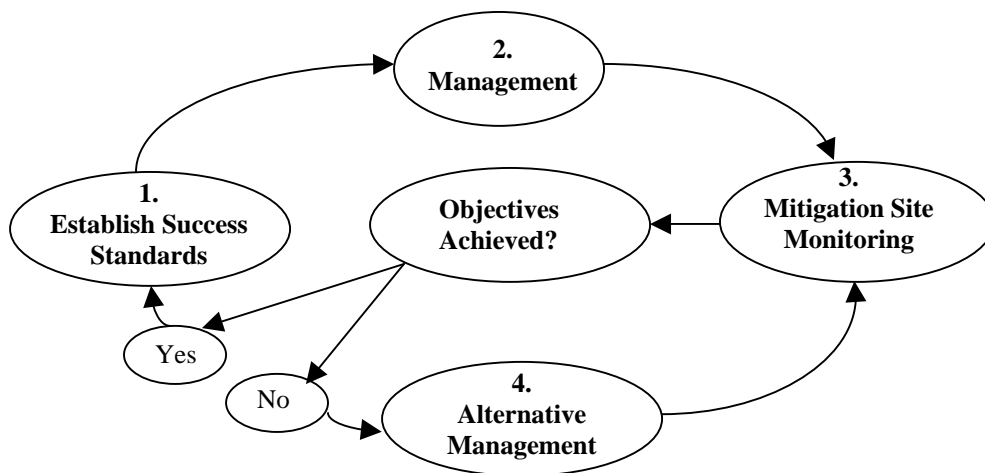
We collect data using a monitoring plan and sampling design developed specifically for each site. The monitoring plan and sampling design address success standards, permit requirements, contingencies, and other considerations as appropriate.

### Adaptive Management

The adaptive management process includes four iterative steps:

1. success standards are developed to describe the desired condition,
2. management action is carried out to meet the success standard,
3. the response of the resource is monitored to determine if the success standard has been met, and
4. management is adapted if the standards are not achieved.

Monitoring is integral to the success of an effective adaptive management strategy. Without valid monitoring data, management actions may or may not result in improved conditions or compliance with regulatory permits. Timely decisions, based on valid monitoring data, result in increased efficiency and higher probabilities of success (Shabman 1995; Thom and Wellman 1996). The adaptive management process is illustrated in Figure 1.1.



(Redrawn from Elzinga et al. 1998)

**Figure 1.1 The Adaptive Management Process**

<sup>4</sup>These methods are based on techniques described in Bonham (1989), Elzinga et al. (1998), Krebs (1999), Zar (1999), and other sources.

### Statistical Rigor

WSDOT's monitoring approach strives to minimize subjectivity in data collection and increase the reliability of data collection and analysis. Important considerations include appropriate sampling design, sampling resolution, random sampling procedures, and sample size analysis. Our goal is to provide customers with an objective evaluation of site conditions based on valid and reliable monitoring data.

### Success Standards and Sampling Objectives

Site objectives and success standards are important elements of a mitigation plan. They indicate the desired state or condition of the mitigation site at a given point in time. Conditional permit requirements, if different from success standards in the mitigation plan, are also evaluated during monitoring activities. Some mitigation plans also provide contingencies if a specific undesirable condition occurs. Contingencies typically initiate a management response at the onset of a particular condition, for example, excessive cover by invasive species or insufficient cover by trees and shrubs.

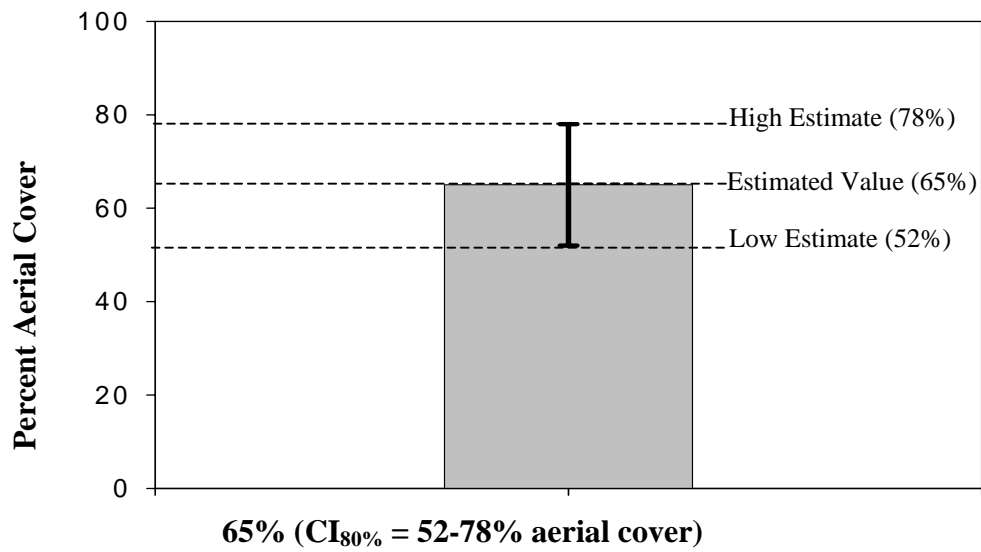
Wetland Assessment and Monitoring program staff thoroughly examine goals, objectives, success standards, and permit requirements to understand the desired site condition or characteristics to be measured. Six elements are sought in relation to each success standard to ensure measurability of the desired condition: species indicator, location, attribute, action, quantity/status, and time frame. Where one or more of the six elements is undocumented or unclear in the mitigation plan or permit, clarification is sought from region staff.

Success Standards are copied verbatim from the mitigation plan in the Success Standards and Sampling Objectives section of each site report. Differences in common usage of the terms *aerial* and *areal* have made their interpretation in mitigation plans difficult. We feel that the term *aerial* better describes the intent of the mitigation plans in most cases. Where we judge the word *areal* has been used arbitrarily in the Success Standards, we follow it with a (*sic*) notation. The Glossary defines the meaning of these words as used in this document.

Information presented in the first table of each site report is obtained directly from the mitigation plan and permits, as appropriate.

Sampling may be required to address success standards unless an efficient and reliable total accounting of the target attribute can be conducted. Sampling objectives are developed to guide the data collection process. Sampling objectives typically include a confidence level and confidence interval half width.

The results of sampling are included in the individual site reports with the confidence level and confidence interval noted as  $(CI_X = Y_1 - Y_2)$ , where  $CI$  = confidence interval,  $X$  = confidence level, and confidence interval width is expressed as  $Y_1$  low estimate to  $Y_2$  high estimate. For example, an estimated aerial cover provided by woody species reported as 65% ( $CI_{80\%} = 52-78\%$  aerial cover) means that we are 80% confident that the true aerial cover value is between 52% and 78% (Figure 1.2).



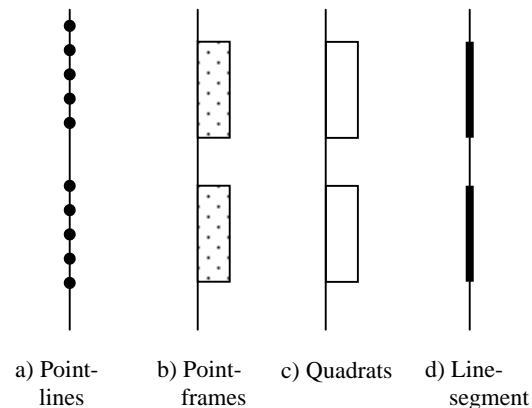
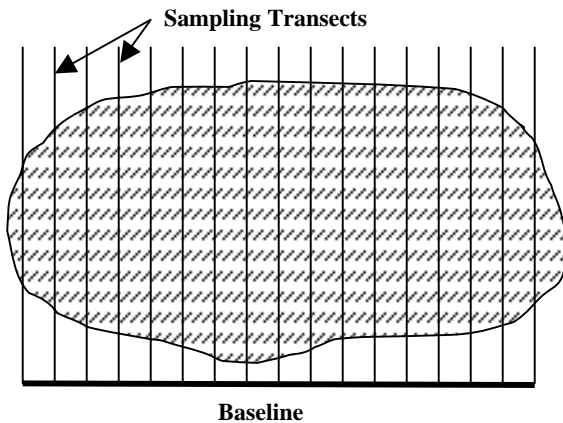
**Figure 1.2 Estimated Cover Value Expressed with Confidence Interval Range**

For compliance purposes, aerial cover calculations include only areas covered by rooted vascular plants (including floating-leaved species). Areas covered by thallophytes (algae, fungi, bacteria), bryophytes (mosses and liverworts), structures, or aquatic vegetation are not included in aerial cover calculations. Scientific names, most common names, and nativity used in this report were obtained from the *PLANTS Database* (USDA 2003). Hydrophytic plant indicator status was obtained from the *National List of Plant Species that Occur in Wetlands: Northwest* (Reed 1988 and 1993). Where invasive or noxious weeds are addressed, county specific listings in the *State Noxious Weed List* are referenced (Washington State Noxious Weed Control Board 2003).<sup>5</sup>

### Sampling Design

When sampling is required, a sampling design is developed for the site or zone of interest. Sampling designs can vary from simple to complex depending on the number and type of attributes to be measured. Specific elements such as the size and shape of the site, the presence of environmental gradients, plant distribution patterns, and the amount of time and resources available for monitoring are factors that influence the sampling design. Elements of the sampling design may include the location of the baseline, orientation of transects (Figure 1.3), the method of data collection, and the number and type of sample units to be used. Depending on the sampling objective and site characteristics, transects may vary in number, length, and separation distance. Sampling transect locations are determined by using either a simple, systematic, stratified, or restricted random sampling method.

<sup>5</sup> In some cases, other nuisance species may be included in invasive cover estimates.



**Figure 1.3 Baseline and Sampling Transects**

**Figure 1.4 (a-d) Sampling Transects and Sample Units**

A diagram showing the sampling design is typically included in mitigation site reports. Sample units appropriate to one or more of the methods described below are randomly located on or adjacent to the sampling transects (Figure 1.4 a-d). These drawings are general representations of the actual sampling designs and do not include specific details.

#### Point-Line Method

The point-line technique (Bonham 1989; Elzinga et al. 1998) can be used where vegetative cover is an attribute of interest. This method involves randomly locating sample units consisting of fixed sets of points along sampling transects (Figure 1.4a). Tools used to collect point-line data include point-intercept devices, pin flags, or densitometers. These tools are used to identify point locations. Target vegetation intercepted by the point locator is recorded. If target species are not encountered on the point; bare soil, non-vascular plant, or habitat structure is recorded as appropriate. For each sample unit, cover is determined based on the number of times target vegetation is encountered divided by the total number of points. For example, if invasive species were encountered on 20 points from a sample unit composed of 100 points, the aerial cover of invasive species for that sample unit is 20 percent.

#### Point-Frame Method

Point-frames are another tool that may be used to measure vegetative cover (Bonham 1989; Elzinga et al. 1998). A point-frame is a rectangular frame that encloses a set of points collectively serving as a sample unit (Figure 1.4b).<sup>6</sup> The sample unit is lowered over herbaceous vegetation and data is recorded where target vegetation intercepts point locations. As with the point-line method, a cover value for each sample unit is determined. For example, if FACW and OBL species were encountered on 20 points in a point-frame composed of 40 points, the aerial cover of FACW and OBL species for that point-frame sample unit is 50 percent.

<sup>6</sup> The WSDOT Wetland Assessment and Monitoring Program typically uses a frame formed with polyvinyl chloride (PVC). Strings span the frame lengthwise and points are marked on the strings using a standard randomization method.

### Quadrat Method

To measure survival or density of planted trees and shrubs in an area, quadrat sample units are randomly located along sampling transects (Bonham 1989; Elzinga et al. 1998). Quadrat width and length are based on characteristics of the vegetative community and patterns of plant distribution. Quadrats are typically located lengthwise along sampling transects (Figure 1.4c). Plants within a quadrat are recorded as alive, stressed or dead. The success standard or contingency threshold can be addressed with a percent survival estimate of plantings, or a density per square meter of living plantings as appropriate. For example, if eight planted woody species were recorded as alive and two were recorded as dead in a sample unit measuring 1 x 20 meters, the survival of planted woody species for that sample unit would be 80%, and the density would be 0.4 live plants per square meter.

### Line-Intercept Method

Cover data for the woody species community is collected using the line-intercept method (Bonham 1989; Elzinga et al. 1998).<sup>7</sup> Line-segments, serving as sample units, are randomly located along sampling transects (Figure 1.4d). All woody vegetation intercepting the length of each sample unit is identified and the length of each canopy intercept recorded. For each sample unit, the sum of the canopy intercept lengths is divided by the total length to calculate an aerial cover value. For example, if woody vegetation was encountered on 80 meters from a 100-meter sample unit, the aerial cover for that sample unit is 80 percent.

### Sample Size Analysis

With each of the above methods, sample size analysis is performed in the field to ensure that an adequate number of sample units are obtained to report the data at the specified confidence level and interval. The mean percent aerial cover value and standard deviation are calculated from the data, and sample size analysis is conducted. For data reported in this document, the following sample size equation for estimating a single population mean or a population total within a specified level of precision was used to perform this analysis (Elzinga et al. 1998).

$$n = \frac{(z)^2 (s)^2}{(B)^2}$$

$z$  = standard normal deviate  
 $s$  = sample standard deviation  
 $B$  = precision level<sup>8</sup>  
 $n$  = unadjusted sample size

A sample size correction to  $n$  is necessary for adjusting “point-in-time” parameter estimates.<sup>9</sup> It is the adjusted  $n$  value that reveals the number of sample units required to report the estimated mean value at a specified level of confidence.

---

<sup>7</sup> Depending on site conditions and other considerations, woody cover data may be collected using the point-line method and a densitometer.

<sup>8</sup> In this equation, the precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.

<sup>9</sup> Adjusted  $n$  values found in this report were obtained using the algorithm for a one-sample tolerance probability of 0.90 (Kupper and Hafner 1989; Elzinga et al 1998).

## Wildlife Monitoring

Many mitigation plans include goals and objectives that address wildlife. For these sites, wildlife monitoring is conducted to provide information to support the results of the vegetation monitoring. An example of an objective that triggers such wildlife monitoring is presented below:

### Objective - Wildlife

Wildlife cover and forage availability for birds and small mammals should increase substantially. The addition of fruit-bearing shrubs and stumps, logs, and brush piles will increase habitat diversity and structure in the newly vegetated areas. Overall, creating an emergent and scrub-shrub wetland is intended to provide feeding, breeding, and resting habitat for birds, small mammals, and amphibians.

Some success standards contain more specific reference to monitoring wildlife. In these cases, a variety of wildlife monitoring techniques (see sections below) are used to evaluate success. An example of such a success standard follows:

### Success Standard:

Development of habitat diversity and structure will be determined by the diversity and numbers of wetland dependent species identified during the monitoring period. The sites will meet this objective if wildlife species that utilize wetlands for some or all of their habitat requirements are located.

Incidental wildlife observations are recorded during all site visits.

## Bird Monitoring

Sites with goals, objectives or success standards addressing the avian community receive three to four bird surveys conducted during the breeding season (April through mid-July). The point count method (Ralph et al. 1993) is used to document species richness and relative abundance.

Species diversity indices ( $H$ ) may be calculated from bird survey data using the Shannon-Wiener function (Krebs 1999). Results are expressed as a mean annual species diversity index.

$$H' = -\sum_{i=1}^s (p_i)(\log p_i)$$

$H'$  = index of species diversity  
 $s$  = number of species  
 $p_i$  = proportion of sample belonging to  $i$ th species

The following  $t$  test is used to test the null hypothesis that diversity indices from different years are equal (Zar 1999).

$$t = \frac{H'_1 - H'_2}{S_{H'_1 - H'_2}}$$

$H'$  = index of species diversity  
 $S_{H'_1 - H'_2}$  = standard error of the difference between species diversity indices  $H'_1$  and  $H'_2$



### Amphibian Monitoring

Sites with goals, objectives, or standards referencing amphibians may be monitored using methods adapted from Olson et al. (1997). Methods may include funnel trapping on sites with a water depth of one decimeter or greater. Call surveys and area searches may be used to assess terrestrial components of sites without standing water. Incidental amphibian observations are recorded during other monitoring activities. Potential for amphibian habitat may be qualitatively assessed.

### **Hydrology Monitoring**

Primary and secondary field indicators of wetland hydrology (ECY 1997) are recorded to address hydrology standards and to aid in future delineation efforts. Wetland mitigation sites are delineated in the spring following the last year of vegetation monitoring so the actual wetland area can be compared to the planned wetland area.

## King County Sites

### SR 18 Frog Pond, King County

The following report summarizes project activities completed by the Washington State Department of Transportation Wetland Assessment and Monitoring Program at the SR 18 Frog Pond wetland mitigation site in July 2003. Monitoring activities on this site included vegetation and wildlife surveys. Table 2.1 provides general site information and Table 2.2 summarizes this year's monitoring results.

**Table 2.1 General Information for the SR 18 Frog Pond Mitigation Site**

|                               |  |            |
|-------------------------------|--|------------|
| <b>Contract Name</b>          | SR 18 312 <sup>th</sup> Way to Covington Way Mitigation                            |            |
| <b>Contract Number</b>        | C4777  |            |
| <b>USACE NWP Number</b>       | 95-4-00223   |            |
| <b>Mitigation Location</b>    | SW corner of the intersection of 299th and 132 <sup>nd</sup> Ave S.E., King County |            |
| <b>Monitoring Period</b>      | 1999 to 2003   |            |
| <b>Year of Monitoring</b>     | 5 of 5   |            |
| <b>Area of Project Impact</b> | 0.39 acres   |            |
| <b>Type of Mitigation</b>     | Wetland Enhancement  | Buffer     |
| <b>Area of Mitigation</b>     | 2.63 acres   | 1.70 acres |

**Table 2.2 Monitoring and Management Summary for the SR 18 Frog Pond Mitigation Site**

| <b>Success Standards</b>  | <b>2003 Results<sup>10</sup></b>       |
|---|--|
| 1. 80% cover of woody species in the wetland  | 64% (CI <sub>90%</sub> = 54-73% cover) |
| 2. 80% cover of woody species on the site   | 64% (CI <sub>95%</sub> = 57-70% cover) |
| 3. > 75% cover by planted or native woody species in the upland and riparian buffer | 64% (CI <sub>90%</sub> = 57-70% cover) |
| 4. Difference in height between shrubs and trees                                    | Present                                |

### Success Standards and Sampling Objectives

The fifth-year success standards listed below were excerpted from the *SR 18 312<sup>th</sup> Way to 304<sup>th</sup> Street Interchange Wetland Mitigation and Monitoring Plan* (Brown 1995). Companion sampling objectives follow the success standard where appropriate. Appendix A contains a complete text of the success standards for this site.

<sup>10</sup> Estimated values are presented with their corresponding statistical confidence interval. For example, 64% (CI<sub>90%</sub> = 54-73% cover) means we are 90% confident that the true aerial cover value is between 54% and 73 percent.

#### Success Standard 1

The wetland should have 80% areal (*sic*) cover of forested and scrub-shrub wetland vegetation (2003).

##### Sampling Objective 1

To be 80% confident the true aerial cover of trees and shrubs in the wetland is within 20% of the estimated cover value.

#### Success Standard 2

The mitigation site should have 80% areal (*sic*) cover of trees and shrubs (2003).

##### Sampling Objective 2

To be 80% confident the true aerial cover of woody species on site is within 20% of the estimated value.

#### Success Standard 3

Upland and riparian forested buffer areas should have 75% cover by forested buffer species planted, or be supplemented or replaced by a native naturally colonizing upland forested plant community at 75% or greater cover (2003).

##### Sampling Objective 3

To be 80% confident the true aerial cover of planted and volunteer native woody species in the upland and riparian buffer is within 20% of the estimated value.

#### Success Standard 4

Habitat structure will change from a single layer of vegetation to multiple layers over time as trees and shrubs mature. Differences in height between shrub and tree layers will be observed (2003).

#### Contingency

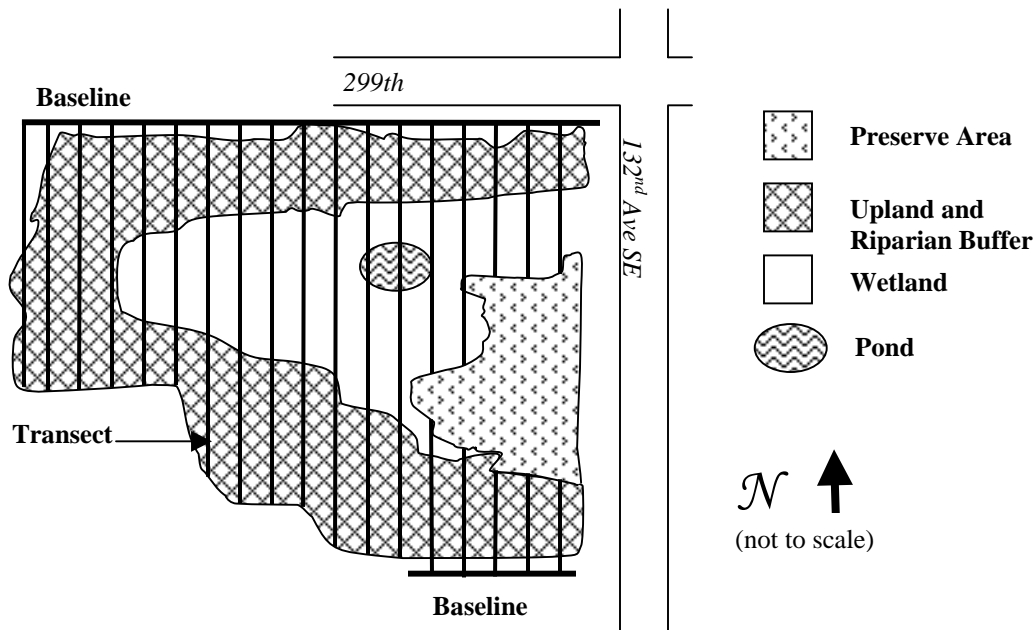
Attempts will be made to limit the spread of exotic species and they will not be allowed to dominate the site. Noxious weeds, such as purple loosestrife will be eliminated immediately if found occurring on the site, before large populations can establish. A weed control program will be implemented if more than 10% of the wetland is invaded by invasive exotic species (2003).

##### Sampling Objective

To be 80% confident the true aerial cover of invasive exotic species on the site is within 20% of the estimated value.

### **Methods**

To assess woody and invasive species aerial cover, a split baseline was established. Twenty-two temporary sampling transects were located along the baseline using a systematic random sampling method. Figure 2.1 shows a sketch of the sampling design used at the SR 18 Frog Pond site.



**Figure 2.1 SR 18 Frog Pond Sampling Design (2003)**

The line-intercept method was used to address woody species cover. Woody species aerial cover in the wetland was evaluated by randomly placing forty-three 11-meter line-segment sample units along the sampling transects (Success Standard 1). Woody cover in the upland and riparian-forested buffer areas was evaluated by randomly locating sixty-three 11-meter sample units along sampling transects (Success Standard 3). To address total woody cover on site, both sets of line-intercept data were used (Success Standard 2).

To address the invasive species contingency, the point-intercept method of data collection was used. Forty-three 15-meter point-line sample units (120 points each) were randomly placed along the sampling transects.

Sample size analysis was conducted using the following equation (Elzinga et al. 1998).

$$n = \frac{(z)^2 (s)^2}{(B)^2}$$

$z$  = standard normal deviate  
 $s$  = sample standard deviation  
 $B$  = precision level<sup>11</sup>  
 $n$  = unadjusted sample size

Photographs were taken to document relative heights of trees and shrubs (Success Standard 4).

<sup>11</sup> In this equation, the precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.

For additional details on the methods described above, see the Methods section of this report.

## Results and Discussion

### Success Standards 1,2, and 3 – Woody Cover

The SR 18 Frog Pond mitigation site has shown positive development in nearly all respects over the five-year monitoring period. Though woody cover on site is below the requirements in Success Standards 1, 2 and 3 (Table 2.3), the tree and shrub community is established and generally reflects the site's goals and objectives. The predominantly native plant population shows considerable diversity in structure and species composition. In the woody plant community alone, the following 16 native species are represented:

|   |   |
|---|---|
| <i>Acer macrophyllum</i> (bigleaf maple)      | <i>Malus fusca</i> (Pacific crabapple)          |
| <i>Alnus rubra</i> (red alder)                | <i>Oemleria cerasiformis</i> (Indian plum)      |
| <i>Cornus sericea</i> (redosier dogwood)      | <i>Physocarpus capitatus</i> (Pacific ninebark) |
| <i>Corylus cornuta</i> (beaked hazelnut)      | <i>Salix lucida</i> (Pacific willow)            |
| <i>Crataegus douglasii</i> (black hawthorn)   | <i>Salix</i> species (willows)                  |
| <i>Frangula purshiana</i> (Pursh's buckthorn) | <i>Thuja plicata</i> (western red cedar)        |
| <i>Fraxinus latifolia</i> (Oregon ash)        | <i>Ribes</i> species (currants)                 |
| <i>Mahonia aquifolium</i> (tall Oregon grape) | <i>Rosa nutkana</i> (Nootka rose)               |

Successful establishment of planted woody species may be due in part to the favorable hydrology throughout the wetland areas. In parts of the intended scrub-shrub zone, dense native emergent plant communities have flourished in the flow of perennial seeps. Though overall woody cover has consequently been affected, the resulting diversity of wetland types and functions may be a relative benefit to the site. Monitoring results for specific success standards follow.

**Table 2.3 Monitoring Results for Woody Aerial Cover (Success Standards 1, 2 and 3)**

| Success Standards   | 2003 Results                           |
|---|--|
| 1. 80% cover of woody species in the wetland  | 64% (CI <sub>90%</sub> = 54-73% cover) |
| 2. 80% cover of woody species on the site   | 64% (CI <sub>95%</sub> = 57-70% cover) |
| 3. > 75% cover by planted or native woody species in the upland and riparian buffer | 64% (CI <sub>90%</sub> = 57-70% cover) |

### Success Standard 4 – Habitat Structure, Height Difference Between Shrubs and Trees

Since its establishment in 1998, the site has shifted from a grass dominated wet hillside, to a diverse mix of woody and emergent wetland areas. Differences in height between trees and shrubs have become increasingly pronounced (Figure 2.2). In 2003, four distinct vegetative layers were identified during site visits. These layers include an upper canopy of pre-existing mature *Acer macrophyllum* (bigleaf maple), a secondary canopy with four to five-meter tall *Salix* species (willows), a shrub layer of two-meter tall *Cornus*

*sericea* (redosier dogwood), *Mahonia nervosa* (short Oregon grape), and an understory of herbaceous vegetation. These structural components are generally considered beneficial for birds and other wildlife species (Johnson and O'Neil 2001).

The objective for Success Standard 4 is to enhance the forested/scrub-shrub wetland and increase the value of the habitat by providing additional feeding, breeding, and resting habitat for birds, small mammals, and amphibians. In order to address the objective directly, bird and amphibian surveys were conducted each year from 1999 to 2003 to verify wildlife presence. Thirty-nine bird species from 19 avian families were documented. Of the 39 bird species, three species are wetland-dependent and nine species are wetland-associated (Table 2.4). Monitoring staff identified several active bird nests on the site. Birds have also been observed using the habitat structures during site visits. The site also provides good breeding and rearing habitat for amphibians.



**Figure 2.2 SR 18 Frog Pond (July 2003)**

Pacific Chorus Frogs (*Pseudacris regilla*) are especially productive here with large numbers of juveniles commonly observed throughout the site each summer. Red-legged Frogs (*Rana aurora*), bullfrogs (*Rana catesbeiana*), and Long-toed Salamanders (*Ambystoma macrodactylum*) have also been observed in and around the pond area during monitoring. The above results satisfy the criteria for Success Standard 4.

**Table 2.4 SR 18 Frog Pond Mitigation Site Bird Status (1999 to 2003)**

| Common Name            | Scientific Name               | Status <sup>12</sup> |
|------------------------|-------------------------------|----------------------|
| Barn Swallow           | <i>Hirundo rustica</i>        | Wetland-associated   |
| Black-capped Chickadee | <i>Poecile atricapillus</i>   | Wetland-associated   |
| Common Yellowthroat    | <i>Geothlypis trichas</i>     | Wetland-dependent    |
| Killdeer               | <i>Charadrius vociferous</i>  | Wetland-associated   |
| Marsh Wren             | <i>Cistothorus palustris</i>  | Wetland-dependent    |
| Red-winged Blackbird   | <i>Agelaius phoeniceus</i>    | Wetland-dependent    |
| Tree Swallow           | <i>Tachycineta bicolor</i>    | Wetland-associated   |
| Violet-green Swallow   | <i>Tachycineta thalassina</i> | Wetland-associated   |
| Warbling Vireo         | <i>Vireo gilvus</i>           | Wetland-associated   |
| Willow Flycatcher      | <i>Empidonax traillii</i>     | Wetland-associated   |
| Wilson's Warbler       | <i>Wilsonia pusilla</i>       | Wetland-associated   |
| Yellow Warbler         | <i>Dendroica petechia</i>     | Wetland-associated   |

<sup>12</sup> Birds are assigned a wetland-dependent or wetland-associated species status based on the classification scheme presented in Brown and Smith (1998). Regional variation occurs. Additional references used to further classify bird species include Thomas (1979), Ehrlich et al. (1988), and Smith et al. (1997).

#### Contingency – No More Than 10% Cover by Invasive Exotic Species on the Site

Invasive cover on site in July of 2003 was estimated to be 9% ( $CI_{80\%} = 6-11\%$  cover). Invasive species still present on site are generally patchy and limited in their distribution. Species of concern include *Cirsium arvense* (Canada thistle), *Leucanthemum vulgare* (oxeye daisy), and *Rubus armeniacus* (Himalayan blackberry).

#### **Management Activities**

Weed control efforts were implemented in June 2003 to keep the invasive cover level below the contingency threshold.

## SR 18 Holder Creek 1, King County

The following report summarizes monitoring activities completed by the Washington State Department of Transportation Wetland Assessment and Monitoring Program at the SR 18 Holder Creek 1 mitigation site in July 2003. Monitoring data were obtained to address fifth-year success standards. Activities included surveys of herbaceous and woody vegetation. Table 3.1 shows this year's monitoring results and Table 3.2 provides general site information.

**Table 3.1 General Information for the SR 18 Holder Creek 1 Mitigation Site**

|  |   |            |
|--|---|------------|
| <b>Contract Name</b>                   | SR 18 Issaquah-Hobart Rd. I/C and Raging River Bridge-Roadside Revegetation |            |
| <b>Contract Number</b>                 | C5239   |            |
| <b>USACE NWP Number</b>                | 95-4-00223  |            |
| <b>Mitigation Location</b>             | SR 18 Issaquah-Hobart I/C northbound on-ramp, King County                   |            |
| <b>Township/Range/Section (impact)</b> | T.22N/R.6E/S.1, 2, T.23N/R.6E/S.36, T.23N/R.7E/S.31, T.23N/R.7E/S.10, 15.   |            |
| <b>Monitoring Period</b>               | 1999 to 2003  |            |
| <b>Year of Monitoring</b>              | 5 of 5  |            |
| <b>Area of Project Impact</b>          | 0.82 acres  |            |
| <b>Type of Mitigation</b>              | Wetland Creation  | Buffer     |
| <b>Area of Mitigation</b>              | 2.16 acres  | 3.87 acres |

**Table 3.2 Monitoring Summary for the SR 18 Holder Creek 1 Mitigation Site**

| <b>Success Standards</b>   | <b>2003 Results<sup>13</sup></b>       |
|--|--|
| 1. 80% cover of woody species on the site                                | 40% (CI <sub>90%</sub> = 35-45% cover) |
| 2. 80% cover of woody species in the wetland                             | 4% (CI <sub>80%</sub> = 3-5% cover)    |
| 3. ≥ 75% cover by native woody species in the upland and riparian buffer | 45% (CI <sub>80%</sub> = 38-52% cover) |
| 4. Difference in height between shrubs and trees                         | None observed                          |

### Success Standards and Sampling Objectives

Fifth-year success standards for the SR 18 Holder Creek 1 mitigation site are summarized from the *Issaquah-Hobart Interchange Supplemental Wetland Mitigation Site 2 Mitigation and Monitoring Plan* (WSDOT 1996). Sampling objectives follow the success standard where appropriate. Appendix B provides the complete text of the success standards for this project.

<sup>13</sup> Estimated values are presented with their corresponding statistical confidence interval. For example, 40% (CI<sub>90%</sub> = 35-45% cover) means we are 90% confident that the true aerial cover value is between 35% and 45 percent.



#### Success Standard 1

The mitigation site should have 80% areal (*sic*) cover of trees and shrubs. (Performance Standard 2e) (2003).

#### Sampling Objective 1

To be 80% confident the true aerial cover of trees and shrubs on site is within 20% of estimated value.

#### Success Standard 2

The wetland should have 80% areal (*sic*) cover of forested and scrub-shrub wetland vegetation. (Performance Standard 1c) (2003).

#### Sampling Objective 2

To be 80% confident the true aerial cover of woody species in the wetland is within 20% of the estimated value.

#### Success Standard 3

Upland and riparian forested buffer areas should have 75% cover by forested buffer species planted, or be supplemented or replaced by a native naturally colonizing upland forested plant community at 75% or greater cover. (Performance Standard 3b) (2003).

#### Sampling Objective 3

To be 80% confident the true aerial cover of native woody species in the upland and riparian buffer is within 20% of the estimated value.

#### Success Standard 4

Habitat structure will change from a single layer of vegetation to multiple layers over time as trees and shrubs mature. Differences in height between shrub and tree layers will be observed (Performance Standard 2d.) (2003).

#### Contingency

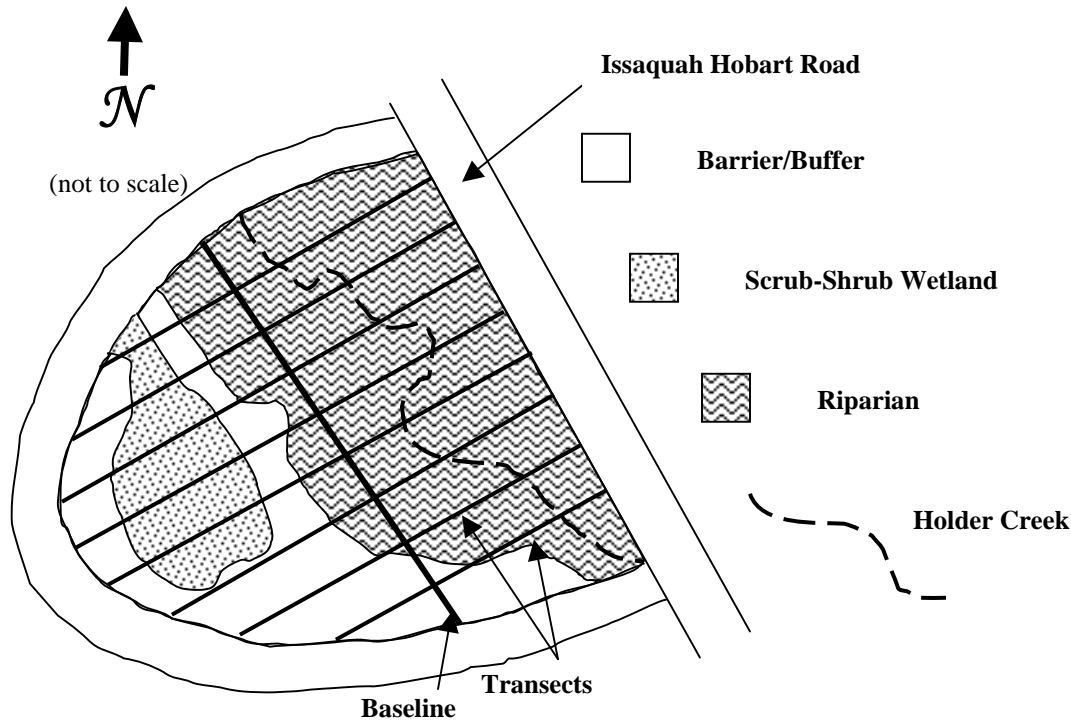
Attempts will be made to limit the spread of exotic species and they will not be allowed to dominate the site. Noxious weeds, such as purple loosestrife will be eliminated immediately if found occurring on the site, before large populations can establish. A weed control program will be implemented if more than 10% of the wetland is invaded by invasive exotic species (2003).

#### Sampling Objective

To be 80% confident the true cover for invasive exotic species on the site is within 20% of the estimated value.

## Methods

To evaluate vegetative communities on site, 19 temporary transects were placed perpendicular to a baseline using a systematic random sampling method (Figure 3.1).



**Figure 3.1** SR 18 Holder Creek 1 Mitigation Site Sampling Design (2003)

The line-intercept and point-intercept methods were used to evaluate cover of woody and herbaceous species. Table 3.3 provides details for the line-intercept and point-line sampling methods used at the mitigation site.

**Table 3.3** Methods Used for Monitoring the SR 18 Holder Creek 1 Mitigation Site

| Performance Standard               | Monitoring Method | Randomization Method | Sample Unit Dimensions | Units | Resolution                       |
|------------------------------------|-------------------|----------------------|------------------------|-------|----------------------------------|
| Woody cover on site                | Line-intercept    | Simple               | 150-meter lines        | 19    | 0.1-meter gap rule <sup>14</sup> |
| Woody cover in the wetland         | Line-intercept    | Simple               | 20-meter lines         | 76    | 0.1-meter gap rule               |
| Woody cover in the upland/riparian | Line-intercept    | Simple               | 100-meter lines        | 23    | 0.1-meter gap rule               |
| Invasive cover (Contingency)       | Point-line        | Systematic           | 100-meter point-line   | 34    | 200 points/unit                  |

<sup>14</sup> Woody plants with canopy gaps less than 0.1 meters were considered continuous with no break in cover.

Sample size analysis was conducted using the following equation.

$$n = \frac{(z)^2 (s)^2}{(B)^2}$$

$z$  = standard normal deviate  
 $s$  = sample standard deviation  
 $B$  = precision level<sup>15</sup>  
 $n$  = unadjusted sample size

To address vertical stratification between trees and shrubs (Success Standard 4), photographs and qualitative observations were made during vegetation monitoring.

For additional details regarding the monitoring methods employed at this site, see the Methods section of this report.

## Results and Discussion

### Success Standard 1, 2 and 3 – Woody Cover across the Entire Site, Woody Cover in the Upland and Riparian Buffer Zones Combined, and Woody Cover in the Wetland

In general, woody species are not well established on this site. Table 3.4 provides a summary of 2003 monitoring results.

The riparian area along Holder Creek supplies most of the woody cover on site due to the prevalence of pre-existing vegetation along the stream bank. Coniferous and deciduous forest species dominate this area.

In the wetland, plant mortality is high (Figure 3.2).



**Figure 3.2 SR 18 Holder Creek 1 (July 2003)**

**Table 3.4 Monitoring Summary for Woody Cover at the SR 18 Holder Creek 1 Mitigation Site**

| Success Standards |   | 2003 Results                           |
|-------------------|---|--|
| 1.                | 80% cover of woody species on the site                                | 40% (CI <sub>90%</sub> = 35-45% cover) |
| 2.                | 80% cover of woody species in the wetland                             | 4% (CI <sub>80%</sub> = 3-5% cover)    |
| 3.                | ≥ 75% cover by native woody species in the upland and riparian buffer | 45% (CI <sub>80%</sub> = 38-52% cover) |

<sup>15</sup> The precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.

*Populus balsamifera* (black cottonwood), and *Salix* species (willows) provide most of the limited woody cover in the wetland. A combination of compacted soils and drought-like conditions may have contributed to the failure of woody species in this zone. Other contributing factors include infestation by black aphids and large mammal herbivory.

Cover is higher in parts of the buffer where *Thuja plicata* (western red cedar), *Acer macrophyllum* (bigleaf maple), *Alnus rubra* (red alder) and *Oemleria cerasiformis* (Indian plum) dominate the woody species canopy.

#### Success Standard 4 – Observable Differences in Height Between Shrubs and Trees

Only the riparian area along Holder Creek has developed an observable difference in height between trees and shrubs. Most of the woody plantings that remain in other zones have shown little or no growth. Therefore, a height comparison between trees and shrubs cannot be made.

#### Contingency 5 – 10% Cover by Invasive Exotic Species on the Site

The estimated cover of invasive species on the site is 17% ( $CI_{80\%} = 13\text{-}22\%$  cover). This figure exceeds the 10% threshold specified in the contingency. *Rubus armeniacus* (Himalayan blackberry), *Rubus laciniatus* (cutleaf blackberry), and *Phalaris arundinacea* (reed canarygrass) dominate the invasive species plant community. These species are present primarily in the riparian buffer.

### **Management Activities**

A multi-disciplinary team has evaluated the site, and is in the process of developing a strategy to increase the success of the site by modifying soils and drainage.

## SR 18 Holder Creek 2, King County

The following report summarizes monitoring activities completed by the Washington State Department of Transportation Wetland Assessment and Monitoring Program at the SR 18 Holder Creek 2 mitigation site in September 2003. Monitoring data were obtained to compare to second-year permit requirements. Activities include vegetation surveys of the wetland and buffer plant communities. Table 4.1 provides general site information and Table 4.2 summarizes this year's monitoring results.

**Table 4.1 General Information for the SR 18 Holder Creek 2 Mitigation Site**

|  |  |                               |
|--|--|-------------------------------|
| <b>Contract Name</b>                   | SR 18 Holder Creek Vicinity Slope Stabilization                      |                               |
| <b>Contract Number</b>                 | C5927  |                               |
| <b>USACE NWP Number</b>                | 98-4-02323   |                               |
| <b>KC DDES Permit Number</b>           | LL CG504   |                               |
| <b>Mitigation Location</b>             | SR 18, Bridge over tributary to Holder Creek at MP 22.3, King County |                               |
| <b>Township/Range/Section (impact)</b> | T.23N/R.7E/S.30  |                               |
| <b>Monitoring Period</b>               | 2002 to 2006   |                               |
| <b>Year of Monitoring</b>              | 2 of 5   |                               |
| <b>Area of Project Impact</b>          | Temporary Wetland: 0.002 acres                                       | Permanent Buffer: 0.080 acres |
| <b>Type of Mitigation</b>              | Wetland Restoration  | Buffer Restoration            |
| <b>Area of Mitigation</b>              | 0.002 acres  | 0.350 acres                   |

**Table 4.2 Monitoring Summary for the SR 18 Holder Creek 2 Mitigation Site**

| <b>Permit Requirements</b>         | <b>2003 Results<sup>16</sup></b>     |
|------------------------------------|--------------------------------------|
| 1. < 10% non-native invasive cover | 1-2% aerial cover                    |
| 2. > 10% shrub cover               | 7% (CI <sub>80%</sub> = 5-10% cover) |

### Permit Requirements and Sampling Objectives

Second-year permit requirements for the SR 18 Holder Creek 2 mitigation site were excerpted from the *King County Clearing and Grading Permit LL CG504* (USACE 98-4-02323). Sampling objectives follow permit requirements, where appropriate. Appendix C provides the complete text of the success standards and permit requirements for this project.

<sup>16</sup> Estimated values are presented with their corresponding statistical confidence interval. For example, 7% (CI<sub>80%</sub> = 5-10% aerial cover) means we are 80% confident that the true aerial cover value is between 5% and 10 percent.

### King County Permit Requirement 1

Non-native invasive plants shall not make up more than 10% of cover in any growing season (2003).

### King County Permit Requirement 2

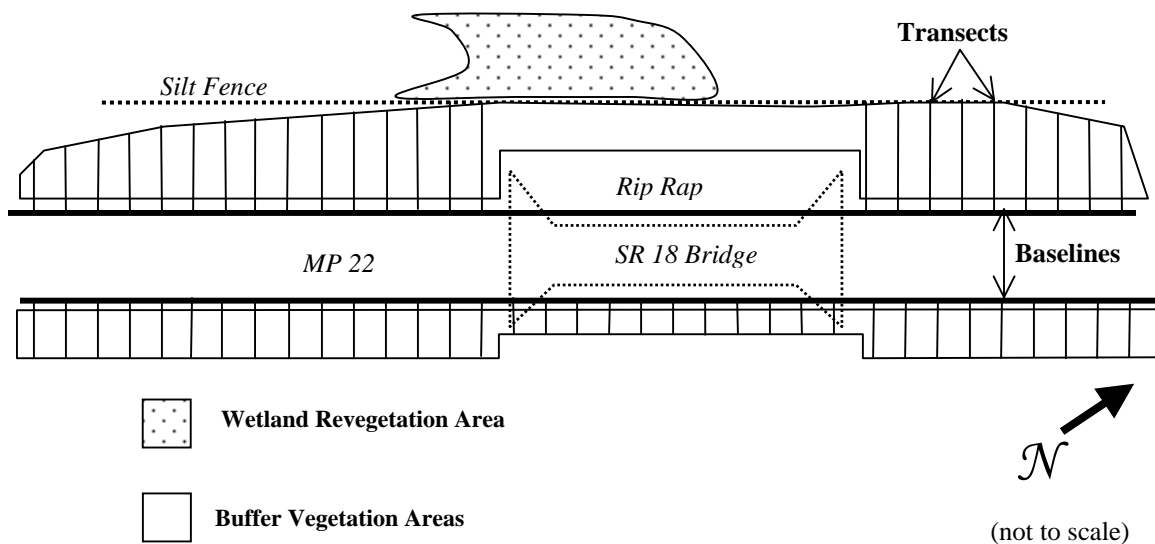
Shrub cover shall be greater than 10% after one year (2003).

### Sampling Objective

To be 80% confident the true aerial cover of shrub species is within 20% of the estimated value.

## **Methods**

Baselines were established parallel to the highway along the edges of the mitigation site. Forty-one temporary transects were placed perpendicular to the baselines using a systematic random sampling method (Figure 4.1).



**Figure 4.1 SR 18 Holder Creek 2 Mitigation Site Sampling Design (2003)**

To address aerial cover of woody species (Permit Requirement 2), the line-intercept method was used. Forty-seven five-meter line-intercept sample units were used to collect the cover data.

Sample size analysis was conducted using the following equation.

$$n = \frac{(z)^2 (s)^2}{(B)^2}$$

$z$  = standard normal deviate  
 $s$  = sample standard deviation  
 $B$  = precision level<sup>17</sup>  
 $n$  = unadjusted sample size

To address cover of non-native invasive plants (Permit Requirement 1), a qualitative estimate was made during the vegetation monitoring.

Photographs were taken as specified in the reporting requirements in the permit. A site sketch is included that shows lines of sight for each photograph. This sketch is presented with the photographs in Appendix D.

For additional details on the methods described above, see the Methods section of this report.

## Results and Discussion

### Permit Requirement 1 – No More Than 10% Non-Native Invasive Cover

The qualitative cover estimate for non-native invasive species is one to two percent. The few invasive species that are present tend to be unevenly distributed primarily on the edges of the site. *Rubus laciniatus* (cutleaf blackberry) may pose some risk to site development encroaching from beyond the silt fence to the south. *Phalaris arundinacea* (reed canarygrass) was observed in the wetland revegetation area at the northwest end of the site. The following non-native invasive species are also present at low cover levels: *Geranium robertianum* (Robert geranium), *Rubus armeniacus* (Himalayan blackberry), *Cirsium vulgare* (bull thistle), *Hypericum perforatum* (common St. Johnswort), *Centaurea diffusa* (diffuse knapweed) and *Sonchus asper* (spiny sowthistle).

### Permit Requirement 2 – Greater Than 10% Shrub Cover

The aerial cover estimate for planted woody species is 7% ( $CI_{80\%} = 5\text{-}10\%$  cover). This value approaches the permit requirement of 10 percent. Though the permit requirement has not been met, re-planting may not be necessary. In the southern portion of the site, planted *Thuja plicata* (western red cedar) and volunteer *Alnus rubra* (red alder) are doing well. On the north side, plantings have generally not done as well. *Rubus spectabilis* (salmonberry), in particular, has experienced high mortality and stress. Nevertheless, *A. rubra*, *Cornus sericea* (redosier dogwood), *Sambucus racemosa* (red elderberry), and *Salix sitchensis* (Sitka willow) appear to be satisfactorily established.

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<sup>17</sup> The precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.

## SR 18 Kendal 1, King County

The following report summarizes monitoring activities completed by the Washington State Department of Transportation Wetland Assessment and Monitoring Program at the SR 18 Kendal mitigation site in August 2003. Monitoring data were obtained to compare to fifth-year success standards and the contingency plan.<sup>18</sup> Activities included vegetation surveys. Table 5.1 provides general site information for the SR 18 Kendal 1 mitigation site, and Table 5.2 summarizes this year's monitoring results.

**Table 5.1 General Information for the SR 18 Kendal 1 Mitigation Site**

|  |  |                   |
|--|--|-------------------|
| <b>Contract Name</b>                       | SR 18 SE 312 Way to Covington Way Mitigation                       |                   |
| <b>Contract Number</b>                     | C4777  |                   |
| <b>USACE IP Number</b>                     | 95-4-00203   |                   |
| <b>Mitigation Location</b>                 | Northwest of SR 18, east of 156 <sup>th</sup> Ave. SE, King County |                   |
| <b>Township/Range/Section (impact)</b>     | T.21N/R.6E/S.3 & 10 and T.22N/R.6E/S.35                            |                   |
| <b>Monitoring Period</b>                   | 1998 to 2005   |                   |
| <b>Year of Monitoring</b>                  | 6 of 8   |                   |
| <b>Area of Project Impact<sup>19</sup></b> | Wetland 1.77acres  | Buffer 2.05 acres |
| <b>Type of Mitigation</b>                  | Wetland Creation   | Buffer Creation   |
| <b>Area of Mitigation</b>                  | 1.80 acres   | 1.91 acres        |
| <b>Type of Mitigation</b>                  | Wetland Enhancement  |                   |
| <b>Area of Mitigation</b>                  | 1.64 acres   |                   |

**Table 5.2 Monitoring and Management Summary from the SR 18 Kendal 1 Mitigation Site**

| <b>Success Standards</b>                         | <b>2003 Results<sup>20</sup></b>       | <b>Management Activities</b> |
|--|--|------------------------------|
| 1. 80% woody cover in the wetland                | 40% (CI <sub>80%</sub> = 35-46% cover) | Replanted in 12/02           |
| 2. ≥ 75% woody cover in the buffer               | 37% (CI <sub>80%</sub> = 31-43% cover) |                              |
| 3. 80% woody cover on the entire site            | 39% (CI <sub>80%</sub> = 35-43% cover) | Replanted in 12/02           |
| 4. Difference in height between shrubs and trees | Present                                |                              |

<sup>18</sup> Results reflect data collected after an accidental maintenance activity that decreased woody vegetation on approximately one acre of the site. Replacement plantings were installed in December 2002. The City of Kent has required three additional years of monitoring.

<sup>19</sup> SR 18 Kendal 1 provides partial compensation for impacts from the SR 18 SE 304<sup>th</sup> Street to Covington Way project. The SR 516 Bartol site provides the remaining compensation for the project.

<sup>20</sup> Estimated values are presented with their corresponding statistical confidence interval. For example, 40% (CI<sub>80%</sub> = 35-46% cover) means we are 80% confident that the true aerial cover value is between 35% and 46 percent.



## **Success Standards and Sampling Objectives**

Success standards and the contingency measure for the SR 18 Kendal 1 mitigation site were excerpted from the *SR 18 SE 304th Street to Covington Way Wetland Mitigation Plan* (Davis 1994). Sampling objectives follow the success standards and contingency measure where appropriate. Appendix D provides the complete text of the success standards and contingency measure for this project.

### Success Standard 1

The wetland should have 80% areal (*sic*) cover of forested and scrub-shrub wetland vegetation (2005).

#### Sampling Objective 1

To be 80% confident the true aerial cover of woody vegetation (FAC and wetter) in the wetland is within 20% of the estimated value.

### Success Standard 2

Upland and riparian forested buffer areas should have 75% cover by forested buffer species planted, or be supplemented or replaced by native naturally colonizing upland forested plant community at 75% or greater cover (2005).

#### Sampling Objective 2

To be 80% confident the true aerial cover of planted and/or native woody species in the upland and riparian forested buffer is within 20% of the estimated value.

### Success Standard 3

The mitigation site should have 80% areal (*sic*) cover of trees and shrubs (2005).

#### Sampling Objective 3

To be 80% confident the true aerial cover of woody species on the entire site is within 20% of the estimated value.

### Success Standard 4

Habitat structure will change from a single layer of vegetation to multiple layers over time as trees and shrubs mature. Differences in height between shrub and tree layers will be observed (2005).

### Contingency

Attempts will be made to limit the spread of exotic species and they will not be allowed to dominate the site. Noxious weeds, such as purple loosestrife will be eliminated immediately if found occurring on the site, before large populations can establish. A weed control plan will be implemented if more than 10% of the wetland is invaded by invasive exotic species (2005).

#### Sampling Objective

To be 80% confident the true aerial cover for exotic invasive species on the entire site is within 20% of the estimated aerial cover value.

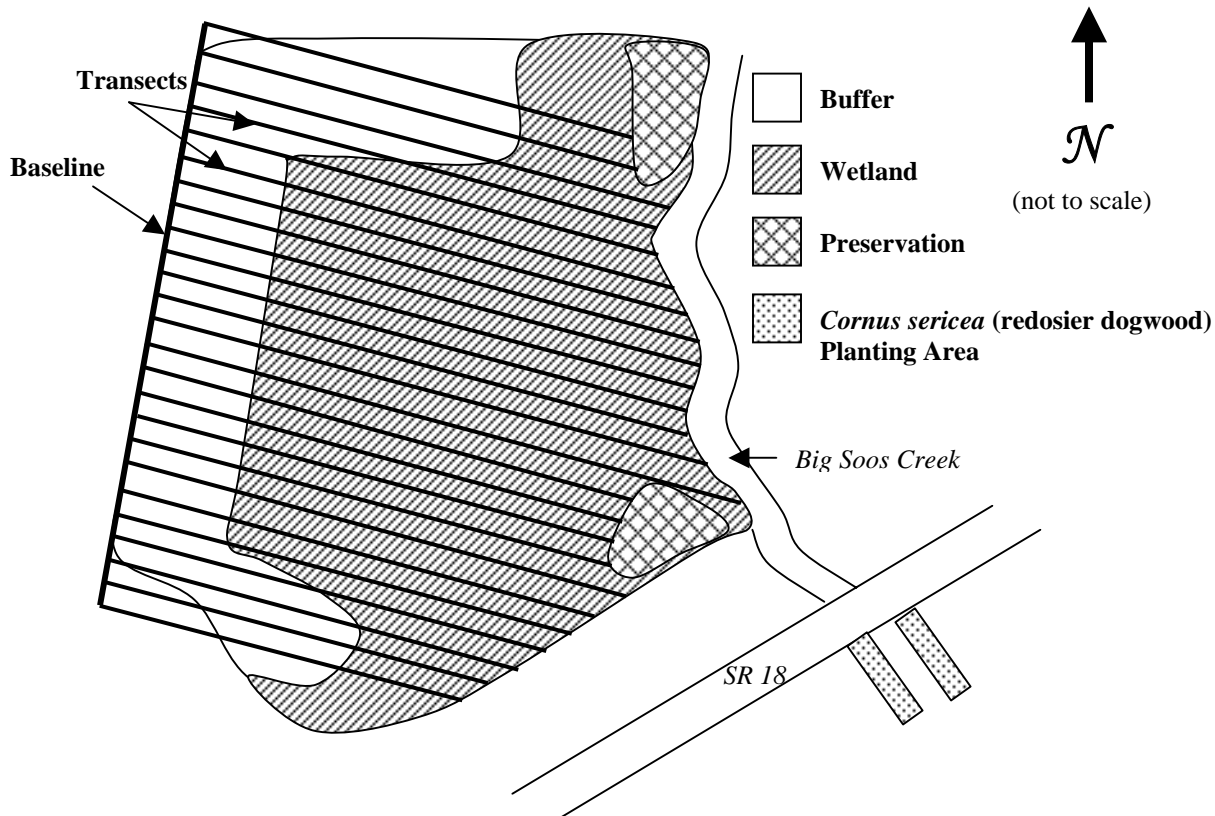
## Methods

To evaluate the cover of woody and invasive vegetation, 31 temporary transects were placed perpendicular to a baseline along the west side of the site using a systematic random sampling method (Figure 5.1). The preserved wetland area was not monitored.

To address woody cover for Success Standards 1, 2, and 3, the line-intercept method was used. Line-segment sample units were randomly located along sampling transects. Data were collected from 71 sample units, each 20-meters in length. To address Success Standards 1, 2, and 3, pertinent subsets of this data were analyzed.

Photos and site observations were made to document differences in height between shrub and tree layers (Success Standard 4).

To address the Contingency, the point-intercept method was used to assess cover of invasive species on the entire site. Data were collected from 28 point-line sample units randomly located along sampling transects in the upland buffer and wetland areas. Each sample unit was 90-meters in length with 180 points each.



**Figure 5.1** SR 18 Kendal 1 Mitigation Site Sampling Design (2003)

Sample size analysis confirmed that sufficient sampling had been completed based on the sampling objectives and the desired level of statistical confidence.

$$n = \frac{(z)^2 (s)^2}{(B)^2}$$

$z$  = standard normal deviate  
 $s$  = sample standard deviation  
 $B$  = precision level<sup>21</sup>  
 $n$  = unadjusted sample size

Habitat structure (Success Standard 4) was addressed on the entire site qualitatively through photographs.

For additional details on the methods described above, see the Methods section of this report.

## Results and Discussion

### Success Standard 1 – 80% Cover by Woody FAC and Wetter Vegetation in the Wetland

The aerial cover of woody FAC and wetter species was estimated to be 40% (CI<sub>80%</sub> = 35-46% cover). Species observed are identified in Table 5.3. As the replanted species start to mature, cover in this zone should increase and may reach the requirement for 2005.

**Table 5.3 SR 18 Kendal 1 Woody FAC and Wetter Species in the Wetland**

| Scientific Name              | Common Name       | FAC Status |
|------------------------------|-------------------|------------|
| <i>Alnus rubra</i>           | red alder         | FAC        |
| <i>Cornus sericea</i>        | redosier dogwood  | FACW       |
| <i>Fraxinus latifolia</i>    | Oregon ash        | FACW       |
| <i>Lonicera involucrata</i>  | twinberry         | FAC+       |
| <i>Physocarpus capitatus</i> | Pacific ninebark  | FACW-      |
| <i>Populus balsamifera</i>   | black cottonwood  | FAC        |
| <i>Rubus spectabilis</i>     | salmonberry       | FAC+       |
| <i>Salix lucida</i>          | Pacific willow    | FACW+      |
| <i>Salix scouleriana</i>     | Scouler's willow  | FAC        |
| <i>Salix sitchensis</i>      | Sitka willow      | FACW       |
| <i>Spiraea douglasii</i>     | hardhack          | FACW       |
| <i>Thuja plicata</i>         | western red cedar | FAC        |

### Success Standard 2 – At Least 75% Woody Cover in the Buffer Area

The aerial cover of woody species was estimated to be 37% (CI<sub>80%</sub> = 31-43% cover) in the upland buffer area. In addition to the woody species observed in the wetland (Table 5.3), *Acer circinatum* (vine maple), *Pseudotsuga menziesii* (Douglas-fir), *Sambucus racemosa* (red elderberry), *Symphoricarpos albus* (snowberry), and *Rubus parviflorus* (thimbleberry) were present in the buffer. Control of *Galium* species (bedstraws) in the

<sup>21</sup> The precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.

northern buffer area may be necessary to ensure further growth. This species appears to be limiting the growth of some plantings.

#### Success Standard 3 – 80% Woody Cover on the Entire Site

Success Standard 3 was addressed by analyzing woody species cover data for the wetland and upland buffer. The aerial cover of woody species across these zones was estimated to be 39% ( $CI_{80\%} = 35\text{-}43\%$  cover). Cover on the site should increase and may reach the requirement by 2005 as the re-planted vegetation starts to mature (Success Standard 3).

#### Success Standard 4 – Observable Differences in Height between Shrub and Tree Layers

A statistically significant difference between the mean heights of the shrub (2.6 meters) and tree (3.2 meters) layers ( $P = 0.002$ ) was present in 2002. Qualitative observations indicate that vertical stratification continues to develop throughout the buffer and wetland areas. This meets the requirements of Success Standard 4. Photographic documentation (Figure 5.2) illustrates the differences in heights observed in 2003.

#### Contingency – Invasive Species

The aerial cover of invasive species was estimated to be 24% ( $CI_{80\%} = 19\text{-}28\%$  cover) on the entire site. The contingency states that a weed control plan will be implemented if more than 10% of the wetland is invaded by invasive exotic species (2005). In Spring 2003, both mechanical and chemical weed control methods were implemented throughout the wetland and buffer. Continued weed control may be necessary to ensure further growth of the plantings and limit the cover of invasive species. The invasive species present on the site are *Cirsium* species (thistles), *Cytisus scoparius* (Scot's broom), *Leucanthemum vulgare* (oxeye daisy), *Phalaris arundinacea* (reed canarygrass), *Rubus* species (blackberries), *Senecio jacobaea* (tansy ragwort), and *Tanacetum vulgare* (common tansy).



**Figure 5.2** SR 18 Kendal 1 Mitigation Site (August 2003)

### **Management Activities**

Replacement plantings were installed in December 2002 because of an accidental maintenance activity that occurred during the fall of 2002. Many woody plantings were mowed, decreasing woody species cover on approximately one acre of the site. Mechanical and chemical weed control was conducted in May and June 2003.

## SR 164 Bass Lake 2, King County

The following report summarizes monitoring activities completed by the Washington State Department of Transportation Wetland Assessment and Monitoring Program at the SR 164 Bass Lake 2 mitigation site in September 2003. Monitoring data was obtained to compare to first-year success standards. Activities included surveys of invasive vegetation and a total count of the woody plantings. Table 6.1 provides general site information and Table 6.2 shows this year's monitoring results.

**Table 6.1 General Information for the SR 164 Bass Lake 2 Mitigation Site**

|  |  |                     |
|--|--|---------------------|
| <b>Contract Name</b>                   | SR 169 Jct. SE 400 <sup>th</sup> Street-Signal               |                     |
| <b>Contract Number</b>                 | C6389  |                     |
| <b>USACE NWP Number</b>                | 2002-4-00231   |                     |
| <b>Mitigation Location</b>             | Intersection of SR 169 and 400 <sup>th</sup> St, King County |                     |
| <b>Township/Range/Section (impact)</b> | T.20N/R.05E/S.2 T.21N/R.5E/S.34, 35, 27, and 36              |                     |
| <b>Monitoring Period</b>               | 2003 to 2012   |                     |
| <b>Year of Monitoring</b>              | 1 of 10  |                     |
| <b>Area of Project Impact</b>          | 0.22 acres   |                     |
| <b>Type of Mitigation</b>              | Wetland Creation   | Wetland Enhancement |
| <b>Area of Mitigation</b>              | 0.42 acres   | 0.08 acres          |

**Table 6.2 Monitoring Summary for the SR 164 Bass Lake 2 Mitigation Site**

| Success Standards  | 2003 Results <sup>22</sup>               |
|--|--|
| 1. Wetland hydrology on 0.4176 acres                               | Inundation observed in April             |
| 2. 100% survival at end of first growing season                    | 84% survival (total count) <sup>23</sup> |
| 3. < 10% cover of King Co. Class A, B-designate and priority weeds | 6% (CI <sub>80%</sub> = 3-8% cover)      |

### Success Standards and Sampling Objectives

First-year success standards for the SR 164 Bass Lake 2 mitigation site were excerpted from the *Final Wetland Mitigation Report SR 164 – SE 369<sup>th</sup> Place & 158<sup>th</sup> Avenue SE (MP 4.72 to MP 6.65)* (WSDOT 2003). Sampling objectives follow the success standards where appropriate. Appendix E provides the complete text of the success standards for this project.

#### Success Standard 1

Wetland creation and restoration areas must achieve 0.4176 acres or more area that has soils that are saturated to the surface, or has standing water present in a monitoring well at

<sup>22</sup> Estimated values are presented with their corresponding statistical confidence interval. For example, 6% (CI<sub>80%</sub> = 3-8% cover) means we are 80% confident that the true aerial cover value is between 3% and 8%.

<sup>23</sup> Replanting is planned for the winter 2003-04 planting season to meet contingency obligations.

12 inches below the surface or less, for a consecutive number of days greater than or equal to 10% of the growing season (2003).

#### Success Standard 2

At the end of the first growing season (2003) all woody species shall be alive and healthy (all dead species will be replaced).

#### Success Standard 3

All King County-listed Class A, B-designate, and County-selected priority noxious weed species will be controlled in the season they are first identified on the mitigation site. Less than 10 percent aerial cover by these species will be maintained throughout the monitoring period including reed canarygrass (*Phalaris arundinacea*).

#### Sampling Objective 3

To be 80% confident the true cover of King County Class A, B-designate, County selected priority weed species, and *P. arundinacea* on site is within 20% of the estimated value in 2003.

### **Methods**

To address survival of the planted species (Success Standard 2), each individual was identified to species and recorded as alive or dead. Empty planting wells were recorded as dead unknowns. The results of the total count were used to determine a survival percentage.

The point-intercept method was used to assess invasive species cover on the site (Success Standard 3). A north to south baseline was established in the center of the site (Figure 6.1). Nineteen temporary transects were placed perpendicular to the baseline using the systematic random method. Fifty-seven 10-meter point-line sample units (20 points each) were placed using the systematic random method along sampling transects.

Sample size analysis was conducted using the following equation.

$$n = \frac{(z)^2 (s)^2}{(B)^2}$$

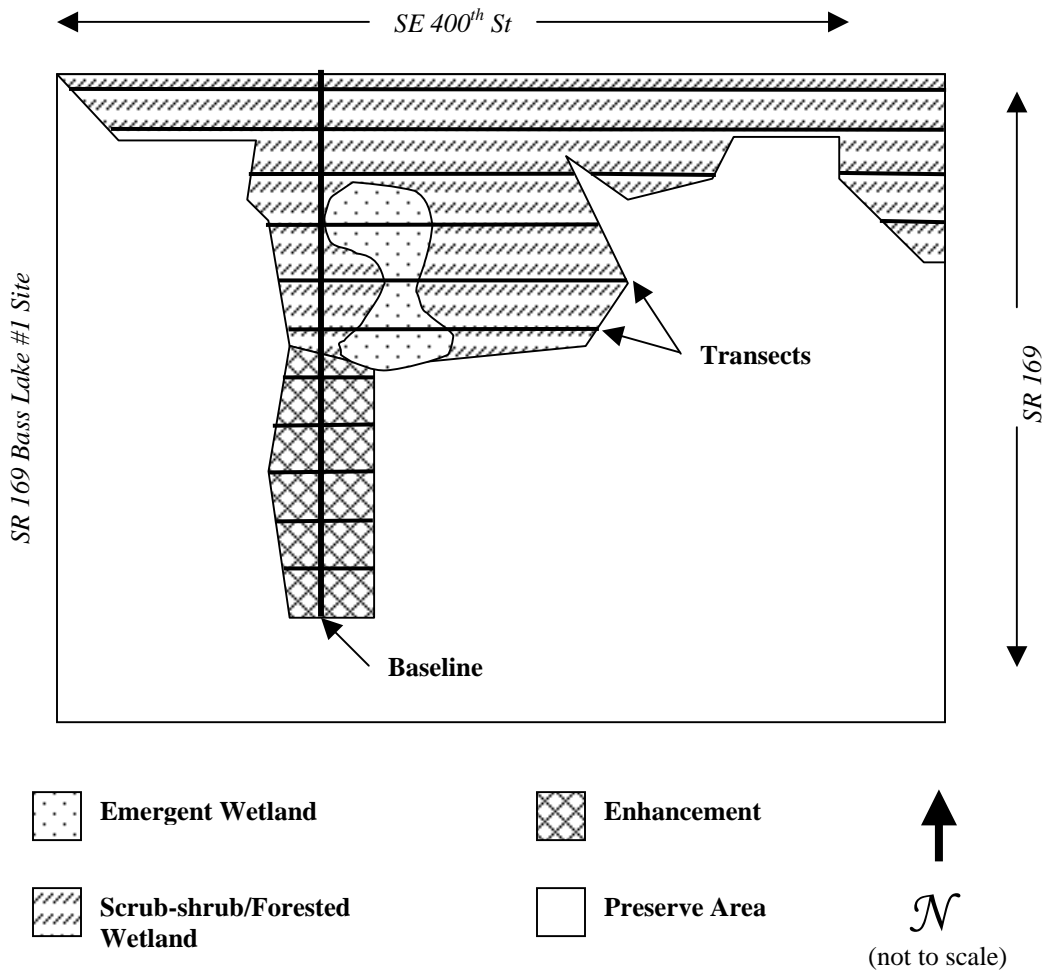
$z$  = standard normal deviate  
 $s$  = sample standard deviation  
 $B$  = precision level<sup>24</sup>  
 $n$  = unadjusted sample size

To address Success Standard 1, primary field indicators of wetland hydrology (ECY 1997) were recorded during a site visit in April 2003. These observations included areas of inundation.

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<sup>24</sup> The precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.

For additional details on the methods described above, see the Methods section of this report.



**Figure 6.1 2003 Sample Design for SR 164 Bass Lake 2 Mitigation Site**

## Results and Discussion

### Success Standard 1 – Wetland Hydrology

Inundation in the planned emergent areas was observed on site through the end of April 2003 by WSDOT construction staff. These observations indicate that it is likely the USACE wetland hydrology criteria were met in 2003.

### Success Standard 2 – Evaluate Survival for Replanting

A total of 2323 plantings are present in the creation and restoration areas. Of these plantings, 2004 were alive and 319 were dead, making survival 86 percent. Replanting is planned for the winter 2003-04 planting season.

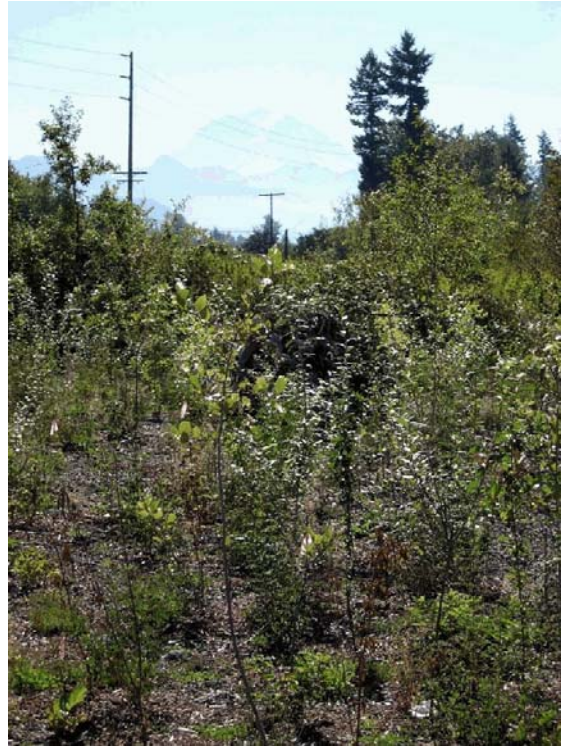
Success Standard 3 – Less Than 10% Cover of King County Class A, B-Designate and Priority Weed Species

Class A, B-designate and priority noxious weeds were not observed on the site. This meets the 10% cover threshold for Success Standard 3.

**Management Activities**

The site was planted in March 2003. Woody plantings were irrigated weekly through the dry summer months. Replanting of woody species is planned for the Winter 2003-04 planting season. This replanting is intended to satisfy a contingency stated in the mitigation plan (WSDOT 2003).

Control of invasive species is ongoing and efforts are targeting any King County Class A, B-designate, and priority weed species that might appear on the site in future years. *Phalaris arundinacea*, *R. armeniacus*, and *R. laciniatus* have also been targeted due to their invasive tendencies.



**Figure 6.2** SR 164 Bass Lake 2 Mitigation Site (September 2003)



## SR 167 Mill Creek Stage 2, King County

The following report summarizes monitoring activities completed by the Washington State Department of Transportation Wetland Assessment and Monitoring Program at the SR 167 Mill Creek Stage 2 mitigation site in July 2003. Monitoring data were obtained to address fifth-year success standards and contingencies. Activities included collection of data on woody and herbaceous plant communities, hydrology, and wildlife. Table 7.1 provides general site information and Table 7.2 summarizes this year's monitoring results.

**Table 7.1 General Information for the SR 167 Mill Creek Stage 2 Mitigation Site**

|  |   |
|--|---|
| <b>Contract Name</b>                   | SR 167 15 <sup>th</sup> NW to 44 <sup>th</sup> Ave. South-Stage 2                   |
| <b>Contract Number</b>                 | C4771   |
| <b>USACE IP Number</b>                 | 95-4-00422  |
| <b>Mitigation Location</b>             | Immediately west of SR 167, south of the SR 18 I/C, King County                     |
| <b>Township/Range/Section (impact)</b> | T.23N/R.5E/S.19, 30, 31; T.22N/R.5E/S.6, 7, 18 & T.21N/R.4E/S.1, 12, 13, 12, 23, 24 |
| <b>Monitoring Period</b>               | 1999 to 2003  |
| <b>Year of Monitoring</b>              | 5 of 5  |
| <b>Area of Project Impact</b>          | 1.88 acres  |
| <b>Type of Mitigation</b>              | Wetland Restoration/ Enhancement  |
| <b>Area of Mitigation</b>              | 2.25 acres  |

**Table 7.2 Monitoring Summary for the SR 167 Mill Creek Stage 2 Mitigation Site**

| <b>Success Standards</b>                                    | <b>2003 Results<sup>25</sup></b>       |
|---|--|
| 1. 25% woody cover in wetland, dominated by wetland species | 22% (CI <sub>80%</sub> = 18-26% cover) |
| 2. 90% of woody vegetation native                           | 100% native species                    |
| 3. 25% native woody cover in buffer                         | 20% (CI <sub>80%</sub> = 16-24% cover) |
| 4. 25% woody cover in wetland enhancement area              | < 1% aerial cover                      |
| 5. < 10% aerial cover by reed canarygrass                   | 68% (CI <sub>90%</sub> = 60-76% cover) |

### Success Standards and Sampling Objectives

Fifth-year success standards for the SR 167 Mill Creek Stage 2 mitigation site were excerpted from the *SR 167 – 15<sup>th</sup> Street SW to South Grady Way Stage 2 Final Wetland Mitigation Plan* (Swanson and Clay-Poole 1995). Sampling objectives follow the success standards where appropriate. The complete text of the success standards for this project is presented in Appendix F.

<sup>25</sup> Estimated values are presented with their corresponding statistical confidence interval. For example, 22% (CI<sub>80%</sub> = 18-26% cover) means we are 80% confident that the true aerial cover value is between 18% and 26 percent.

#### Success Standard 1

The wetland will have at least 25% cover by woody vegetation dominated by FAC or FACW species (2003).

#### Sampling Objective 1

To be 80 % confident the true aerial cover value for FAC and wetter woody species in the wetland is within 20% of the aerial cover estimate in 2003.

#### Success Standard 2

At least 90% of the woody vegetation (trees and shrubs) will be composed of native species (2003).

#### Success Standard 3

Upland buffer will have at least 25% cover by native trees and shrubs (2003).

#### Sampling Objective 3

To be 80% confident the true cover value of native, woody vegetation in the upland buffer is within 20% of the aerial cover estimate in 2003.

#### Success Standard 4

The wetland enhancement area will have at least 25% areal (*sic*) cover by native trees and shrubs (2003).

#### Success Standard 5

Areal (*sic*) cover by reed canarygrass shall not exceed 10% (2003).

#### Sampling Objective 5

To be 80% confident the true aerial cover of *Phalaris arundinacea* (reed canarygrass) is within 20% of the estimated value on the entire site in 2003.

#### Contingency

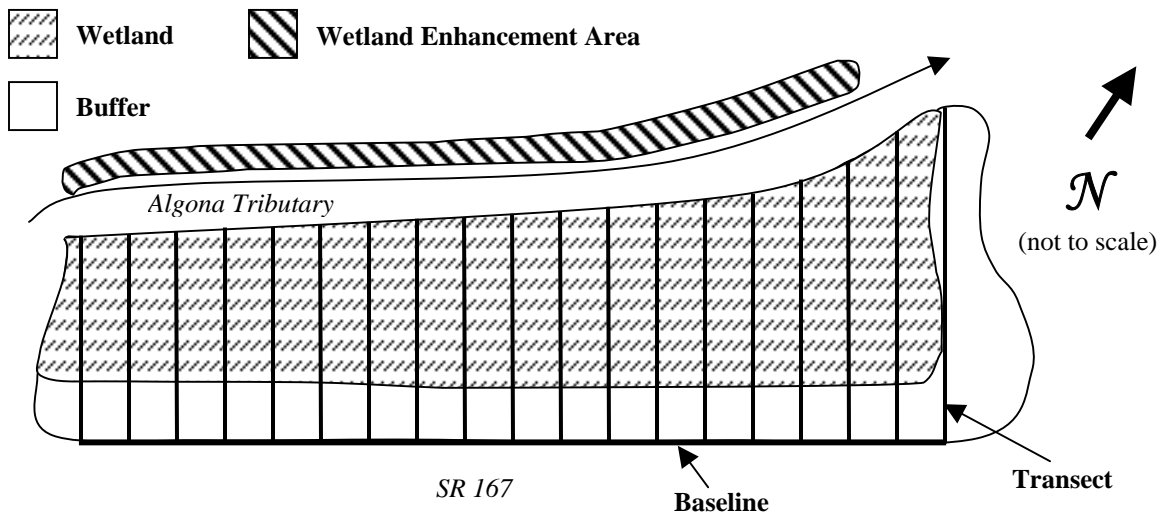
If areal (*sic*) coverage of wetland plants is less than 50% after the fifth-year, such as reasonable measures will be performed as are necessary to establish appropriate wetland vegetation and the monitoring program will be extended until the standards are met. WSDOT will perform all reasonable measures considered necessary to establish and maintain a functional wetland system.

### **Methods**

A baseline was placed parallel to SR 167 to facilitate data collection on woody and herbaceous plant communities. Thirty-eight temporary transects were placed perpendicular to the baseline using a systematic random sampling method. See Figure 7.1 for a visual depiction of the sampling design.

Woody cover requirements in Success Standards 1 and 3 were addressed using the line-intercept method. Thirty-seven line-intercept sample units 15 meters in length were randomly located in the upland buffer to address the aerial cover of woody species in the

buffer. Twenty-one line-intercept sample units 45 meters in length were randomly placed in the wetland to address the aerial cover of woody species in the wetland.



**Figure 7.1 SR 167 Mill Creek Stage 2 Mitigation Site Sampling Design (2003)**

Standards relating to herbaceous cover were addressed using the point-line method. Twenty-one point-line sample units 60 meters in length (120 points per sample unit) were randomly located across the entire site to address the contingency and standard regarding *P. arundinacea* and other invasive species. Twenty-one point-line sample units 45 meters in length (90 point locations per unit) were randomly placed in the wetland zone to address the contingency regarding FAC-OBL plant cover.

Sample size analysis confirmed that sufficient sampling had been completed based on the sampling objectives and the desired level of statistical confidence. The following sample size equation was used to perform the analysis on data collected.

$$n = \frac{(z)^2 (s)^2}{(B)^2}$$

$z$  = standard normal deviate  
 $s$  = sample standard deviation  
 $B$  = precision level<sup>26</sup>  
 $n$  = unadjusted sample size

Monitoring personnel identified woody vegetation to species to address the amount of native species on the site (Success Standard 2).

For additional details on the methods described above refer to the Methods section of this report.

<sup>26</sup> In this equation, the precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.

## Results and Discussion

### Success Standard 1 – 25% Aerial Cover by Primarily FAC-FACW Woody Vegetation

The aerial cover of woody vegetation in the wetland was estimated to be 22% ( $CI_{80\%} = 18\text{--}26\%$  cover). This estimated value is close to the required cover of 25 percent. The species providing the majority of this cover are *Cornus sericea* (redosier dogwood), *Populus balsamifera* (black cottonwood), and *Salix lucida* (Pacific willow). These species and all the other native woody species observed on site are FAC and wetter (Table 7.3).

### Success Standard 2 – At Least 90% of the Woody Vegetation is Native

Relative cover of woody species observed on the site was qualitatively estimated to be 97% cover. This exceeds the fifth-year standard. The two non-native woody species that were observed are *Cytisus scoparius* (Scot's broom) and *Rubus armeniacus* (Himalayan blackberry). Table 7.3 lists the native woody species found onsite.

**Table 7.3 Native Woody Species Observed at the SR 167 Mill Creek Stage 2 Site**

| Scientific Name              | Common Name       | FAC Status | Wildlife Food Source <sup>27</sup> |
|------------------------------|-------------------|------------|------------------------------------|
| <b>Wetland</b>               |                   |            |                                    |
| <i>Alnus rubra</i>           | red alder         | FAC        |                                    |
| <i>Cornus sericea</i>        | redosier dogwood  | FACW       | X                                  |
| <i>Fraxinus latifolia</i>    | Oregon ash        | FACW       |                                    |
| <i>Physocarpus capitatus</i> | Pacific ninebark  | FACW-      |                                    |
| <i>Populus balsamifera</i>   | black cottonwood  | FAC        |                                    |
| <i>Salix lucida</i>          | Pacific willow    | FACW+      | X                                  |
| <i>Salix sitchensis</i>      | Sitka willow      | FACW       | X                                  |
| <i>Thuja plicata</i>         | western red cedar | FAC        |                                    |
| <b>Upland</b>                |                   |            |                                    |
| <i>Acer circinatum</i>       | vine maple        | FAC-       | X                                  |
| <i>Alnus rubra</i>           | red alder         | FAC        |                                    |
| <i>Pseudotsuga menziesii</i> | Douglas-fir       | FACU       |                                    |
| <i>Rubus parviflorus</i>     | thimbleberry      | FAC-       | X                                  |
| <i>Symphoricarpos albus</i>  | snowberry         | FACU       | X                                  |

### Success Standard 3 – 25% Aerial Cover in Upland Buffer by Native Trees and Shrubs

The aerial cover of woody vegetation in the buffer was estimated to be 20% ( $CI_{80\%} = 16\text{--}24\%$  cover). This value approaches the 25% cover requirement. The majority of the cover is provided by the following native species: *Alnus rubra* (red alder), *Symphoricarpos albus* (snowberry), *Rubus parviflorus* (thimbleberry), *Acer circinatum* (vine maple), *Thuja plicata* (western red cedar), and *P. balsamifera*.

<sup>27</sup> Cooke (1997) was used to identify wildlife food sources.

#### Success Standard 4 – 25% Aerial Cover in Enhancement Area by Native Woody Species

The wetland enhancement area on the northwest side of the Algona tributary is not safely accessible from the main portion of the site due to deep water and unsure footing near the creek. This has made it difficult to quantitatively address this standard. Visual estimates indicate the plantings provide less than one percent aerial cover. *Salix* species (willows) provide the only woody cover in this area. The 25% cover standard has not been met.

#### Success Standard 5 – Less than 10% Aerial Cover by Reed Canarygrass on the Site

The aerial cover estimate for *P. arundinacea* on the entire site was estimated to be 68% ( $CI_{90\%}$  = 60-76% cover). This exceeds the 10% cover threshold. Achieving this standard may be difficult because the site is surrounded by *P. arundinacea*.

The aerial cover of noxious weeds on the entire site was estimated to be 69% ( $CI_{90\%}$  = 60-77% cover). This triggers the contingency contained in the mitigation plan, which states that invasive exotic species shall not be allowed to dominate the site. The cover provided by other invasive species is approximately one percent, and includes *Cirsium arvense* (Canada thistle), *Cirsium vulgare* (bull thistle), and *Lythrum salicaria* (purple loosestrife).

#### Contingency – At Least 50% Cover of Wetland Plants in the Wetland

The aerial cover estimate for FAC and wetter vegetation in the wetland zone is 98% ( $CI_{99\%}$  = 96-100% cover). Although this exceeds the contingency requirement of 50% cover, most of the cover is provided by *Phalaris arundinacea*.

#### Other Information

Vertical and horizontal structural complexity is increasing as the trees and shrubs continue to develop. *Salix lucida* exceeds five meters in height, rising above the two-meter shrub layer. This development of vertical complexity increases the habitat diversity found on this site. The value of wildlife habitat on the site has been improved due presence of species that provide a fruit or seed source (Table 7.3).

### **Management Activities**

*Phalaris arundinacea* was mechanically cleared from around planted trees and shrubs on the mitigation site in early May 2003. A small number of *L. salicaria* individuals were flagged and removed in September 2003.

## SR 169 Bass Lake 1, King County

The following report summarizes monitoring activities completed by the Washington State Department of Transportation Wetland Assessment and Monitoring Program at the SR 169 Bass Lake 1 mitigation site in September 2003. Monitoring data were obtained to compare to first-year success standards. Activities included a survey of invasive vegetation and a total count of woody plantings. Table 8.1 provides general site information and Table 8.2 shows this year's monitoring results.

**Table 8.1 General Information for the SR 169 Bass Lake 1 Mitigation Site**

|  |  |                     |
|--|--|---------------------|
| <b>Contract Name</b>                   | SR 169 Junction SE 400 <sup>th</sup> Street-Signal               |                     |
| <b>Contract Number</b>                 | C6389  |                     |
| <b>USACE NWP Number</b>                | 2001-04-01096  |                     |
| <b>KC DDES Permit Number</b>           | L01CG431   |                     |
| <b>Mitigation Location</b>             | Intersection of SR 169 and 400 <sup>th</sup> Street, King County |                     |
| <b>Township/Range/Section (impact)</b> | T.20N/R.6E/S1,2,13   |                     |
| <b>Monitoring Period</b>               | 2003 to 2012   |                     |
| <b>Year of Monitoring</b>              | 1 of 10  |                     |
| <b>Area of Project Impact</b>          | 0.49 acres   |                     |
| <b>Type of Mitigation</b>              | Wetland Creation/Restoration                                     | Wetland Enhancement |
| <b>Area of Mitigation</b>              | 0.73 acres   | 0.60 acres          |

**Table 8.2 Monitoring Summary for the SR 169 Bass Lake 1 Mitigation Site**

| <b>Success Standards</b>   | <b>2003 Results</b>                      |
|--|--|
| 1. Wetland hydrology on 0.731 acres                                | Inundation observed in April             |
| 2. 100% survival at end of first growing season                    | 84% survival (total count) <sup>28</sup> |
| 3. < 10% cover of King Co. Class A, B-designate and priority weeds | None observed                            |

### Success Standards and Sampling Objectives

First-year success standards for the SR 169 Bass Lake 1 mitigation site were excerpted from the *SR 169: SE 400<sup>th</sup> St. Channelization and Signal (MP 2.49 to MP 2.86) Wetland Mitigation Plan* (Leonard and Sullivan 2002). Sampling objectives follow the success standard where appropriate. Appendix G provides the complete text of the success standards and additional permit requirements for this project.

<sup>28</sup> Replanting is planned for the winter 2003-04 planting season in order to meet contingency obligations.

### Success Standard 1

Creation and restoration areas must achieve 0.731 acres or more area that has inundation or saturation to within 12 inches of the surface for at least two weeks during the growing season (Table 3) (2003).

### Success Standard 2

At the end of the first growing season (2003) all woody species shall be alive and healthy (all dead species will be replaced).

### Success Standard 3

All King County-listed Class A, B-designate, and County-selected priority noxious weed species will be controlled in the season they are first identified on the mitigation site. Less than 10 percent aerial cover by these species will be maintained throughout the monitoring period.

### Sampling Objective 3

To be 80% confident the true cover of King County-listed Class A, B-designate, and County-selected priority noxious weed species is within 20% of the estimated value in 2003.

## **Methods**

To address survival of the planted species (Success Standard 2), each individual was identified to species and recorded as alive or dead. Empty planting wells were recorded as dead unknowns. The results of the total count were used to determine a survival percentage.

The point-line method was used to assess invasive species cover on the site (Success Standard 3). A baseline was placed along the west edge of the site (Figure 8.1). Twenty-three temporary transects were placed perpendicular to the baseline using the systematic random sampling method. Twenty-eight 20-meter point-line sample units (40 points each) were randomly placed along sampling transects.

Sample size analysis was conducted using the following equation.

$$n = \frac{(z)^2 (s)^2}{(B)^2}$$

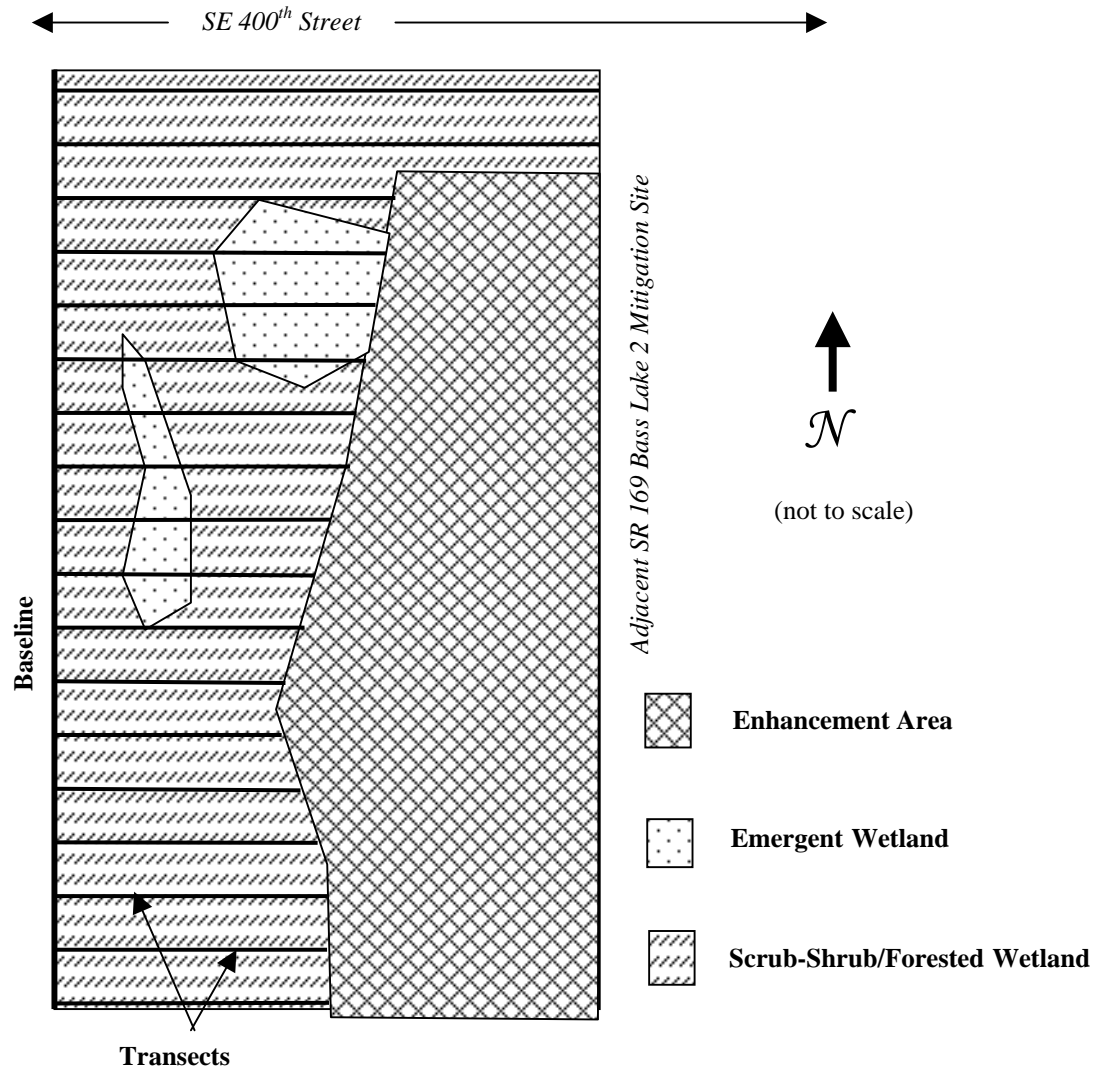
$z$  = standard normal deviate  
 $s$  = sample standard deviation  
 $B$  = precision level<sup>29</sup>  
 $n$  = unadjusted sample size

To address Success Standard 1, primary field indicators of wetland hydrology (ECY 1997) were recorded during a site visit in April 2003. These observations included areas of inundation.

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<sup>29</sup> The precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.

For additional details on the methods described above, see the Methods section of this report.



**Figure 8.1 2003 Sample Design at the SR 169 Bass Lake 1 Mitigation Site**

## Results and Discussion

### Success Standard 1 – Wetland Hydrology

Inundation in the planned emergent areas was observed through the end of April 2003 by WSDOT construction staff. These observations suggest that the USACE wetland hydrology criterion was met in 2003.



### Success Standard 2 – Evaluate Survival for Replanting

Survival was estimated in each zone to address replanting needs. A total of 2374 plantings were counted in the scrub-shrub and forested wetland areas. Of these plantings, 1991 were alive and 383 were dead, resulting in a survival rate of 84% (Figure 8.2). A qualitative evaluation in the enhancement area indicated that the survival rate in this area was similar to the creation and restoration areas.



**Figure 8.2** SR 169 Bass Lake 1 Mitigation Site (Sept. 2003)

### Success Standard 3 – Less Than 10% Aerial Cover by King County-Listed Weed Species

King County-listed Class A, B-designate, and county selected priority noxious weed species were not observed on the site. This meets the 10% cover threshold for Success Standard 3.

### **Management Activities**

Control of invasive species is ongoing and efforts are targeting any King County Class A, B-designate, and priority weed species that might appear on the site in future years.

*Phalaris arundinacea*, *R. armeniacus*, and *R. laciniatus* have also been targeted due to their invasive tendencies. Weed control measures and replanting of dead plantings are intended to comply with contingencies found in the mitigation plan (Leonard and Sullivan 2002). Planting of the site was completed in March 2003. Replacement planting is planned for the winter 2003-04 planting season. Woody plantings were irrigated weekly throughout the dry summer months.

## SR 202 Rutherford Creek, King County

The following report summarizes monitoring activities completed by the Washington State Department of Transportation Wetland Assessment and Monitoring Program at the SR 202 Rutherford Creek mitigation site in September 2003. Monitoring data were obtained to compare to first-year permit requirements. Activities included a total count of planted trees and shrubs and vegetation surveys. Table 9.1 provides general site information and Table 9.2 shows this year's monitoring results.

**Table 9.1 General Information for the SR 202 Rutherford Creek Mitigation Site**

|  |  |                     |
|--|--|---------------------|
| <b>Contract Name</b>                   | SR 202 Evans Creek Drainage Slough Bridge  |                     |
| <b>Contract Number</b>                 | C6164                                      |                     |
| <b>USACE NWP Number</b>                | 2001-4-00219                               |                     |
| <b>KC DDES Permit Number</b>           | L01CG183 and L01SAX01                      |                     |
| <b>Location</b>                        | SR 202 at MP 18.8 and MP 11.1, King County |                     |
| <b>Monitoring Period</b>               | 2003 to 2007                               |                     |
| <b>Year of Monitoring</b>              | 1 of 5                                     |                     |
| <b>Area of Project Impact</b>          | 0.0523 acres                               |                     |
| <b>Type of Mitigation</b>              | Wetland Restoration                        | Wetland Enhancement |
| <b>Area of Mitigation<sup>30</sup></b> | 0.0590 acres                               | 0.0012 acres        |

**Table 9.2 Monitoring Summary for the SR 202 Rutherford Creek Mitigation Site**

| <b>Permit Requirements</b>  | <b>2003 Results<sup>31</sup></b>       |
|---|--|
| 1. 100% survival of planted woody species                               | 91% survival (total count)             |
| 2. 60% cover of native FAC and wetter herbaceous species in the wetland | 35% (CI <sub>80%</sub> = 28-42% cover) |

### Permit Requirements and Sampling Objectives

First-year requirements for the SR 202 Rutherford Creek mitigation site were excerpted from the *King County Clearing and Grading Permit* (L01CG183 and L01SAX01). Sampling objectives follow permit requirements where appropriate. Appendix H provides the complete text of the permit requirements for this project.

<sup>30</sup> The Patterson Creek portion of the site is still under construction. When this portion is completed, there will be an additional 0.04 acres of enhancement.

<sup>31</sup> Estimated values are presented with their corresponding statistical confidence interval. For example, 35% (CI<sub>80%</sub> = 28-42% cover) means we are 80% confident that the true aerial cover value is between 28% and 42 percent.

### Permit Requirement 1

Wetland and buffer monitoring reports must contain Methods, Results, Analysis, and Recommendations sections. Reports must include description/data for:

- (a) Plant survival, vigor, and aerial coverage from every plant community (transect data);
- (b) Site hydrology, including extent of inundation, saturation, depth to groundwater, function of any hydrologic structures, inputs, outlets, etc.;
- (c) Slope conditions, site stability, any structures or special features;
- (d) Buffer conditions, e.g. surrounding land use, use by humans, wild and domestic creatures;
- (e) Observed wildlife, including amphibians, avians, and others;
- (f) Soils, including texture, Munsell color, rooting and oxidized rhizospheres; (Years 1 and 5 only per Steve Shipe. See Communication 29 May 2003) and
- (g) 4" x 6" color photographs taken from permanent photo-points.

### Permit Requirement 2

In year-1 achieve 100% survival of woody plant species (2003).

### Permit Requirement 3

In year-1 achieve 60% aerial cover of native, facultative or wetter herbaceous plant species (where specified) in the wetland (2003).

### Sampling Objective 3

To be 80% confident the true aerial cover of native FAC and wetter herbaceous species in the wetland at MP 18.8 is within 20% of the estimated value.

## **Methods**

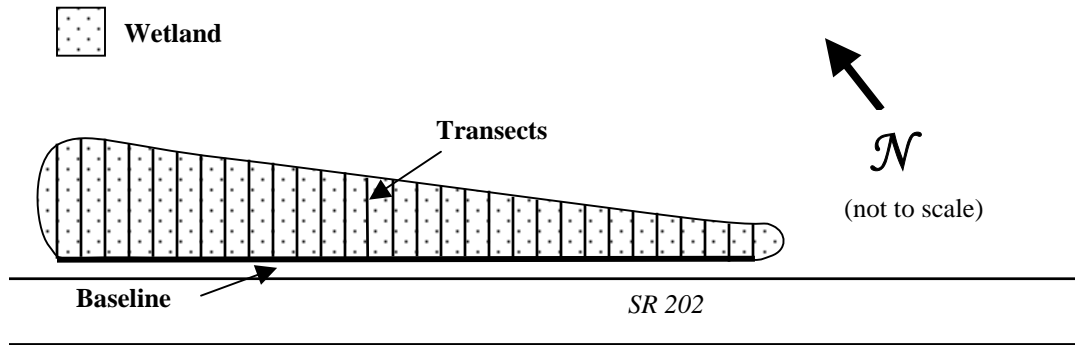
To address Permit Requirement 1b, primary and secondary field indicators of wetland hydrology (ECY 1997) were recorded during site visits in March, April, and September 2003.

Permanent photo points were established at the MP 18.8 Berm and the Rutherford Creek planting area to address Permit Requirements 1a, 1b, 1c, 1d, and 1g. General observations were also made during site visits to address these requirements and Permit Requirement 1e.

Soil observations were made in October at MP 18.8 Berm and the Rutherford Creek area to address Permit Requirement 1f.

To address survival of planted species (Permit Requirement 1a and 2), plantings in each area were identified and recorded as alive or dead. Empty planting wells were recorded as dead unknowns.

To evaluate the aerial cover of native, facultative and wetter herbaceous plant species in the wetland at MP 18.8 (Permit Requirement 3), 21 temporary transects were placed perpendicular to a baseline using a systematic random sampling method (Figure 9.1). Twenty-seven two-meter point-line sample units (20 points each) were randomly positioned along the sampling transects.



**Figure 9.1 SR 202 Rutherford Creek MP 18.8 Berm Mitigation Site Sampling Design (2003)**

Sample size analysis confirmed that sufficient sampling had been completed based on the sampling objective and the desired level of statistical confidence. The following sample size equation was used to perform this analysis on the collected data.

$$n = \frac{(z)^2 (s)^2}{(B)^2}$$

$z$  = standard normal deviate  
 $s$  = sample standard deviation  
 $B$  = precision level<sup>32</sup>  
 $n$  = unadjusted sample size

For additional details on the methods described above, see the Methods section of this report.

## Results and Discussion

Calculations required by the King County permit are contained in Appendix H.

### Permit Requirement 1a and 2 – 100% Survival

Based on a total count, the survival of planted woody species was 90% at the Rutherford Creek planting area, 93% at the MP 18.8 Berm, and 91% over the entire site (Table 9.3). Volunteer *Rosa* species (roses) and *Salix* species (willows) are starting to colonize the Rutherford Creek planting area. Replanting is necessary to meet the permit requirement.

<sup>32</sup> The precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.

**Table 9.3 Survival of Planted Woody Species at the SR 202 Rutherford Creek Mitigation Site**

| Plant Name                                      | Alive      | Dead      | Total      | Survival   |
|---|------------|-----------|------------|------------|
| <b>Rutherford Creek Planting Area</b>           |            |           |            |            |
| <i>Cornus sericea</i> (redosier dogwood)        | 45         | 16        | 61         | 74%        |
| <i>Physocarpus capitatus</i> (Pacific ninebark) | 2          | 3         | 5          | 40%        |
| <i>Rosa</i> species (roses)                     | 20         | 4         | 24         | 83%        |
| <i>Rubus spectabilis</i> (salmonberry)          | 35         | 7         | 42         | 83%        |
| <i>Salix</i> species (willows)                  | 189        | 0         | 189        | 100%       |
| <i>Symphoricarpos albus</i> (common snowberry)  | 14         | 3         | 17         | 82%        |
| Unknown   | 0          | 2         | 2          | 0%         |
| Total   | 305        | 35        | 340        | 90%        |
| <b>MP 18.8 Berm Planting Area</b>               |            |           |            |            |
| <i>Cornus sericea</i> (redosier dogwood)        | 28         | 0         | 28         | 100%       |
| <i>Physocarpus capitatus</i> (Pacific ninebark) | 17         | 3         | 20         | 85%        |
| <i>Ribes</i> species (currants)                 | 9          | 0         | 9          | 100%       |
| <i>Rosa</i> species (roses)                     | 16         | 1         | 17         | 94%        |
| <i>Rubus spectabilis</i> (salmonberry)          | 7          | 0         | 7          | 100%       |
| <i>Salix</i> species (willows)                  | 150        | 0         | 150        | 100%       |
| <i>Spiraea douglasii</i> (rose spirea)          | 23         | 0         | 23         | 100%       |
| Unknown   | 0          | 15        | 15         | 0%         |
| Total   | 250        | 19        | 269        | 93%        |
| <b>Site Total</b>                               | <b>555</b> | <b>54</b> | <b>609</b> | <b>91%</b> |

**Permit Requirement 1b – Hydrology**

Field indicators of wetland hydrology (ECY 1997) were present during site visits from May through October. Observations of inundation at the MP 18.8 Berm area and saturation to the surface in the Rutherford Creek wetland area during each visit suggest that these areas are saturated to the surface for at least 12.5 percent during the growing season (Appendix I, Figure 17.7: Photo Point 5). Table 9.4 shows the dates and results of the hydrology observations.

**Table 9.4 Hydrology Summary SR 202 Rutherford Creek Mitigation Site**

| Date               | MP 18.8 Berm                  | Rutherford Creek Wetland Area |
|--------------------|-------------------------------|-------------------------------|
| March 20, 2003     | Up to 2.0 decimeters of water | Saturated to surface          |
| March 31, 2003     | Up to 2.0 decimeters of water | Saturated to surface          |
| April 9, 2003      | Up to 2.0 decimeters of water | Saturated to surface          |
| April 21, 2003     | Up to 1.5 decimeters of water | Saturated to surface          |
| September 15, 2003 | Up to 1.5 decimeters of water | Saturated to surface          |
| October 29, 2003   | Up to 2.1 decimeters of water | Saturated to surface          |

**Permit Requirement 1c – Slope Conditions and Site Stability**

A silt fence was installed at the Rutherford Creek portion of the site as an erosion control measure during construction and the beginning of plant establishment (Figure 9.2). In-stream structures appeared to be stable. Exposed soils and evidence of erosion were not observed on the site.

#### Permit Requirement 1d – Buffer Conditions and Surrounding Land Use

The mitigation sites are located in a rural environment. Land use adjacent to the Rutherford Creek planting area consists of a residential home with a pond and fruit trees on the north side of SR 202 and wooded acreage on the south side. At the MP 18.8 Berm, wooded acreage borders the northern side of the site and SR 202 and a golf course borders the southern side. Other surrounding buffers in the nearby area of the sites include old farms, pastures, wooded acreage, and a few small businesses.



**Figure 9.2 Silt Fence at the Rutherford Creek Section (April 2003)**

#### Permit Requirement 1e – Incidental Wildlife Observations

At the MP 18.8 Berm, tadpoles, Pacific Chorus Frogs (*Pseudacris regilla*) and Garter snakes (*Thamnophis* species) were observed. Pacific Chorus Frogs, Garter snakes, and juvenile fish were also observed at the Rutherford Creek planting area.

#### Permit Requirement 1f – Soils

Soil data was collected in October 2003 to address Permit Requirement 1f. Table 9.5 provides a summary of the data collected at each soil pit. Two soil pits were located at the Rutherford Creek section of the site (riparian and wetland) and one soil pit was located at the MP 18.8 Berm (wetland). Redox features within the wetland soil pits were not observed. As hydric soils develop, these features should become present.

**Table 9.5 SR 202 Rutherford Creek Soil Summary**

| Depth (cm)                       | Munsell Color | Roots                       | Redox Features | Clay (%) | Sand (%) | Notes                                |
|----------------------------------|---------------|-----------------------------|----------------|----------|----------|--------------------------------------|
| <b>Rutherford Creek Riparian</b> |               |                             |                |          |          |                                      |
| 10                               | 10YR2/1       | Very fine (many)            | None           | < 27     | 30       |                                      |
| 39                               | 10YR4/1       | Very fine (few)             | None           | < 27     | 80       | Gravelly, water at 35 centimeters    |
| 50                               | 7.5YR3/1      | None                        | None           | < 27     | 50       |                                      |
| <b>Rutherford Creek Wetland</b>  |               |                             |                |          |          |                                      |
| 7                                | 10YR3/1       | Very fine (many)            | None           | < 27     | 85       | Gravelly, water at 7 centimeters     |
| 30                               | NA            | Very fine (few), fine (few) | None           | < 27     | > 85     | Extremely gravelly, water bearing    |
| <b>MP 18.8 Berm Wetland</b>      |               |                             |                |          |          |                                      |
| 9                                | 10YR3/1       | Very fine (few)             | None           | 7        | 70       | Organic matter, saturated to surface |
| 47                               | 10YR4/1       | Very fine (few)             | None           | < 27     | 80       | Extremely gravelly                   |

#### Permit Requirement 1g – Permanent Photo Points

Permanent photo points were established and photographs were taken at the Rutherford Creek Planting area and at the MP 18.8 Berm. A map of the photo point locations and the photographs are included in Appendix H.

#### Permit Requirement 3 – 60% Cover of Native FAC and Wetter Species in the Wetland at the MP 18.8 Berm

The aerial cover of native FAC and wetter herbaceous species in the wetland at the MP 18.8 Berm was estimated to be 35% ( $CI_{80\%} = 28-42\%$  cover). This does not meet the permit requirement. Dense vegetation was present along the entire edge of the wetland, but vegetation so far has not established in the shallow ponded areas. Native FAC and wetter species present in the wetland are *Equisetum* species (horsetails), *Juncus effusus* (common rush), and *Scirpus microcarpus* (panicked bulrush).

#### Other Observations – Invasives

Invasive species observations were recorded across the Rutherford Creek and MP 18.8 Berm planting areas. The aerial cover of these species across both of the planting areas combined was qualitatively estimated to be less than five percent.

Invasive species at Rutherford Creek Planting Area:

- *Cirsium vulgare* (bull thistle)
- *Geranium robertianum* (stinky Bob)
- *Phalaris arundinacea* (reed canarygrass)
- *Rubus armeniacus* (Himalayan blackberry)
- *Solanum dulcamara* (climbing nightshade)

Invasive species at MP 18.8 Berm

- *Cirsium arvense* (Canada thistle)
- *Rubus laciniatus* (cutleaf blackberry)
- *Solanum dulcamara* (climbing nightshade)

## SR 203 Stillwater Hill Road, King County

The following report summarizes monitoring activities completed by the Washington State Department of Transportation Wetland Assessment and Monitoring Program at the SR 203 Stillwater Hill Road mitigation site in September 2003. Monitoring data were obtained to compare to second-year success standards. Activities included a total count of planted trees and shrubs. Table 10.1 provides general site information and Table 10.2 shows this year's monitoring results.

**Table 10.1 General Information for the SR 203 Stillwater Hill Road Mitigation Site**

|                               |  |
|-------------------------------|--|
| <b>Contract Name</b>          | SR 203 NE Stillwater Hill Road and Fay Road                      |
| <b>Contract Number</b>        | C6054  |
| <b>Location</b>               | SR 203 between NE Stillwater Hill Road and Fay Road, King County |
| <b>Monitoring Period</b>      | 2002 to 2004   |
| <b>Year of Monitoring</b>     | 2 of 3   |
| <b>Area of Project Impact</b> | 0.307 acres  |
| <b>Type of Mitigation</b>     | Buffer Enhancement   |
| <b>Area of Mitigation</b>     | 0.614 acres  |

**Table 10.2 Monitoring Summary for the SR 203 Stillwater Hill Road Mitigation Site**

| <b>Success Standard</b>                 | <b>2003 Results</b>        |
|---|----------------------------|
| > 80% survival of planted woody species | 83% survival (total count) |

### Success Standards and Sampling Objectives

Second-year success standards for the SR 203 Stillwater Hill Road mitigation site were excerpted from the *SR 203 Vicinity NE 77th Supplement #3 to Final Wetland Mitigation Plan* (WSDOT 2001). Appendix I provides the complete text of the success standards for this project.

#### Success Standard

Minimum 80% survival of planted species (2003).

#### Contingency

In the second and third-year of plant establishment, if over 20% of the plants are mortal then replanting of the mortal species will occur (2003).



## Methods

To address survival of the planted species (Success Standard 1 and Contingency), plantings in each zone (Figure 10.1) were identified and recorded as alive or dead. Empty planting wells were recorded as dead unknowns.

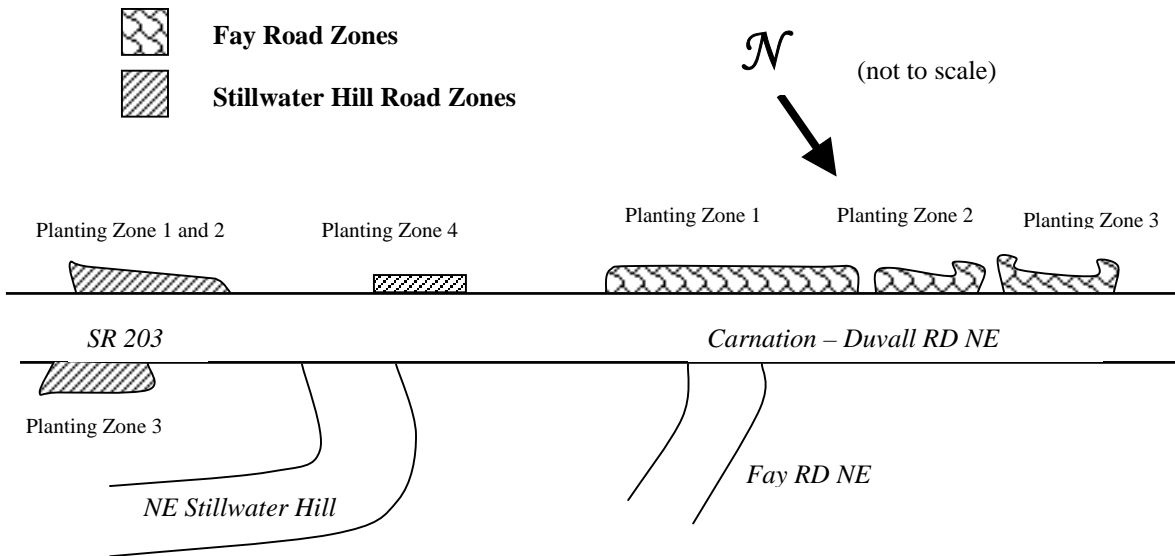


Figure 10.1 SR 203 Stillwater Hill Road Mitigation Site Sketch (2003)

## Results and Discussion

### Success Standard – 80% Survival

Based on a total count, the survival of planted woody species in 2003 was 83 percent. This exceeds the second year 80% survival requirement (Table 10.3). Figure 10.2 shows part of Planting Zone 3 near Fay Road.

Each of the five planted species was present. Volunteer *Populus balsamifera* (balsam poplar), *Rosa* species (roses), *Rubus spectabilis* (salmonberry), and *Symphoricarpos albus* (common snowberry) are present throughout the site.



Figure 10.2 SR 203 Stillwater Hill Road Mitigation Site (September 2003)

**Table 10.3 Survival of Planted Woody Species at the SR 203 Stillwater Hill Road Mitigation Site in 2003**

| Plant Name                                     | Alive      | Dead       |
|--|------------|------------|
| <b>Fay Road</b>                                |            |            |
| <i>Acer circinatum</i> (vine maple)            | 65         | 3          |
| <i>Holodiscus discolor</i> (oceanspray)        | 129        | 0          |
| <i>Rubus spectabilis</i> (salmonberry)         | 124        | 34         |
| <i>Sambucus racemosa</i> (red elderberry)      | 123        | 5          |
| <i>Symphoricarpos albus</i> (common snowberry) | 194        | 1          |
| <i>Rosa</i> species (roses)                    | 2          | 0          |
| Unknown  | 0          | 17         |
| Total  | 637        | 60         |
| <b>Stillwater Hill Road</b>                    |            |            |
| <i>Acer circinatum</i> (vine maple)            | 14         | 0          |
| <i>Holodiscus discolor</i> (oceanspray)        | 23         | 1          |
| <i>Rubus spectabilis</i> (salmonberry)         | 74         | 37         |
| <i>Sambucus racemosa</i> (red elderberry)      | 13         | 1          |
| <i>Symphoricarpos albus</i> (common snowberry) | 105        | 2          |
| Unknown  | 0          | 22         |
| Total  | 229        | 63         |
| Plantings not observed                         | 0          | 51         |
| <b>Site Total</b>                              | <b>866</b> | <b>174</b> |

Based on ocular estimates, aerial cover of invasive species across the site has increased to approximately seven percent cover. In 2002, the aerial cover of invasive species was qualitatively estimated to be less than one percent cover. *Phalaris arundinacea* (reed canarygrass) and *Rubus armeniacus* (Himalayan blackberry) are the main species of concern. These species may pose a threat to future site development if not controlled. Other invasive species on site are *Cirsium* species (thistles), *Hypericum perforatum* (common St. Johnswort), *Solanum dulcamara* (climbing nightshade), *Tanacetum vulgare* (common tansy), and *Taraxacum officinale* (common dandelion).

## Snohomish County Sites

### SR 5 Ash Way, Snohomish County

The following report summarizes monitoring activities completed by the Washington State Department of Transportation Wetland Assessment and Monitoring Program at the SR 5 Ash Way mitigation site in August and September 2003. Vegetation survey data were obtained to compare to fifth-year objectives. Table 11.1 provides general site information for the SR 5 Ash Way mitigation site, and Table 11.2 summarizes this year's monitoring results.

**Table 11.1 General Information for the SR 5 Ash Way Mitigation Site**

|                                      |  |                            |
|--------------------------------------|--|----------------------------|
| <b>Contract Name</b>                 | SR 5 Lynnwood Park and Ride Lot #2   |                            |
| <b>Contract Number</b>               | C5251  |                            |
| <b>USACE NWP Number</b>              | 97-4-00651   |                            |
| <b>Mitigation Location</b>           | South of 164 <sup>th</sup> Ave SW, 1000 feet W. of Ash Way, Snohomish County |                            |
| <b>Township/Range/Section (site)</b> | T.27N/R.4E/S.11/NW 1/4   |                            |
| <b>Monitoring Period</b>             | 1999 to 2003   |                            |
| <b>Year of Monitoring</b>            | 5 of 5   |                            |
| <b>Impact Acreage</b>                | 0.46 acres   |                            |
| <b>Type of Mitigation</b>            | Wetland Creation   | Buffer Creation            |
| <b>Area of Mitigation</b>            | 0.51 acres   | 7.60 meter (25 foot) strip |

**Table 11.2 Monitoring Summary for the SR 5 Ash Way Mitigation Site**

| Objectives   | Results                         |
|--|---------------------------------|
| 1. Create 0.51 acres of wetland  | 0.46 acres (delineated in 2002) |
| 2. Create 0.43 acres of buffer   | 0.48 acres (delineated in 2002) |
| 3. Food chain support  | Yes                             |
| 4. Sediment and nutrient trapping                                      | No                              |
| 5. Water storage capacity  | Intermittent                    |
| 6. Increase in wildlife habitat diversity                              | Yes                             |
| 7. $\geq 27$ habitat structures present                                | Yes                             |
| 8. Fruit-bearing shrubs will provide food for avians and small mammals | Yes                             |

### Objectives

Fifth-year objectives and contingencies for the SR 5 Ash Way mitigation site were excerpted from the *SR 5 Ash Way Park and Ride Wetland Mitigation Plan* (WSDOT 1997). Appendix J provides the complete text of the performance criteria for this project.

#### Objective 1a

The mitigation site will include 0.26 acres of forested wetland, 0.25 acres of scrub-shrub wetland, and 0.43 acres of upland buffer (2003).

#### Objective 1b

The vegetation planted will provide value as food chain support and sediment and nutrient trapping as compared to existing site conditions (2003).

#### Objective 1c

Water storage capacity will be increased (2003).

#### Objective 2a

Wildlife habitat diversity will be increased by additions of native species plantings and from the combination of the establishment of early seral vegetation and climax vegetation (2003).

#### Objective 2b

There will be at least twenty-seven habitat structures (logs, stumps with rootwads, and brush piles) within the boundary of the created wetland and its buffer (2003).

#### Objective 2c

The addition of fruit-bearing shrubs will provide food for avians and small mammals (2003).

#### Objective 3

There will be 0.43 acres of buffer surrounding the created wetland (2003).

#### Contingency 1

Mitigation goals will be accomplished with successful native vegetation plantings (2003).

#### Contingency 2

The mitigation plan is designed to utilize and promote the growth of native vegetation (2003).

### **Methods**

A wetland delineation was conducted in 2002 to address Objectives 1a and 3. The methods used are described in the *Washington State Wetlands Identification and Delineation Manual* (ECY 1997). Acreages were determined using a Global Positioning System (Trimble TSCO data logger) to map the wetland and buffer boundaries.

The *Wetland Functions Characterization Tool for Linear Projects* (Null et al. 2000) was used to address Objectives 1b, 1c, and 2a. Qualitative observations were also made to address these objectives along with Objectives 2b, 2c, and the contingencies.

## Results and Discussion

### Objective 1a and 3 – Create 0.26 Acres Forested Wetland, 0.25 Acres Scrub-Shrub Wetland, and 0.43 Acres Buffer

Delineation of the wetland in 2002 identified 0.46 acres of wetland and 0.48 acres of buffer. The wetland acreage is slightly less than planned while the buffer acreage exceeds the requirement.

### Objectives 1b and 1c – Food Chain Support, Sediment and Nutrient Trapping, and Water Storage Capacity

A functions assessment was completed in 2002. Results show the site primarily provides organic matter that is available for transport to downhill locations (food chain support). Other likely functions include general habitat suitability, amphibian habitat, wetland-associated bird habitat, and native plant richness. Emergent, scrub-shrub, and forested classes are present throughout the wetland.

Flood flow alteration and sediment, nutrient and toxicant removal are functions not likely to be provided by the site because most of the wetland is scrub-shrub and forested classes on a slope. Also, evidence of seasonal flooding (water storage capacity) was not observed, but might be present during rare storm events. Table 11.3 summarizes the planned and obtained functions.

**Table 11.3 SR 5 Ash Way Mitigation Site – Planned and Obtained Functions**

| Planned Functions              | Function Replaced/Gained | 2002 Functions Assessment   |
|--------------------------------|--------------------------|---|
| Biofiltration                  | No                       |   |
| Sediment and nutrient trapping | No                       |   |
| Flow storage                   | Intermittent             | During rare flood events only   |
| Groundwater recharge           | No                       |   |
| Wildlife habitat               | Replaced                 | General habitat suitability, amphibian habitat, and wetland-associated bird habitat |
|                                | Gained                   | Native plant richness   |
|                                | Gained                   | Organic matter for export (food chain support)                                      |

### Objective 2a and 2b – Increase in Wildlife Habitat Diversity

Currently, emergent, scrub-shrub, and forested classes are all present on site. Heights of planted shrubs and trees currently range from approximately one to 10 meters tall. The required 27 habitat structures were observed on site in Fall 2002. These structures ranged from stumps with rootwads and logs to brush piles. As the tree and shrub canopies start to close over the habitat structures, habitat complexity may increase, providing additional benefits for birds and small mammals. Bird species have been observed using these structures during the monitoring period.

### Objective 2c – Fruit-Bearing Shrubs Will Provide Food

Eighteen fruit-bearing shrubs were observed throughout the site (Table 11.4). Three of these species were pre-existing: *Prunus* species (plums), *Malus* species (apples), and

*Pyrus* species (pears). Black-capped Chickadees (*Poecile atricapillus*) and Barn Swallows (*Hirundo rustica*) have been observed feeding on site during the monitoring period.

**Table 11.4 SR 5 Ash Way Mitigation Site – Fruit-Bearing Shrubs**

| Scientific Name              | Common Name           | Classification <sup>33</sup> |
|------------------------------|-----------------------|------------------------------|
| <i>Acer circinatum</i>       | vine maple            | Shrub                        |
| <i>Cornus sericea</i>        | redosier dogwood      | Shrub                        |
| <i>Crataegus douglasii</i>   | black hawthorn        | Shrub/Small Tree             |
| <i>Frangula purshiana</i>    | Pursh's buckthorn     | Tree                         |
| <i>Ilex aquifolium</i>       | English holly         | Shrub                        |
| <i>Lonicera involucrata</i>  | twinberry             | Shrub                        |
| <i>Malus</i> species         | apples                | Tree                         |
| <i>Oemleria cerasiformis</i> | Indian plum           | Shrub                        |
| <i>Prunus</i> species        | plums                 | Tree                         |
| <i>Pyrus</i> species         | pears                 | Tree                         |
| <i>Rubus armeniacus</i>      | Himalayan blackberry  | Shrub                        |
| <i>Rubus laciniatus</i>      | cutleaf blackberry    | Shrub                        |
| <i>Rubus parviflorus</i>     | thimbleberry          | Shrub                        |
| <i>Rubus spectabilis</i>     | salmonberry           | Shrub                        |
| <i>Rubus ursinus</i>         | California blackberry | Shrub                        |
| <i>Salix</i> species         | willows               | Shrub/Tree                   |
| <i>Sambucus racemosa</i>     | red elderberry        | Shrub                        |
| <i>Symphoricarpos albus</i>  | snowberry             | Shrub                        |

#### Contingency 1 and 2 – Successful Establishment of Native Vegetation

The aerial cover of native woody species was qualitatively estimated to be 90% (Figure 11.1). Young volunteer *Acer macrophyllum* (bigleaf maple), *A. rubra*, *Crataegus douglasii* (black hawthorn), *Pseudotsuga menziesii* (Douglas-fir), *Salix lucida* (Pacific willow), and *Thuja plicata* (western red cedar) are present throughout the site. Both planted and recruited species appear to be successfully established.



**Figure 11.1 SR 5 Ash Way Mitigation Site (September 2003)**

<sup>33</sup> Cooke (1997) was used to identify fruit-bearing species.

## SR 5 Stanwood/Bryant, Snohomish County

The following report summarizes monitoring activities completed by the Washington State Department of Transportation Wetland Assessment and Monitoring Program at the SR 5 Stanwood Bryant mitigation site in July 2003. Monitoring data were obtained to compare to the success standard. Activities included surveys of the planted and existing wetland plant communities. Table 12.1 provides general site information and Table 12.2 summarizes this year's monitoring results.

**Table 12.1 General Information for the SR 5 Stanwood/Bryant Mitigation Site**

|  |  |
|--|--|
| <b>Contract Name</b>                   | SR 5 Stanwood/Bryant Vicinity NB Weigh Station |
| <b>Contract Number</b>                 | C5446  |
| <b>USACE NWP Number</b>                | 98-4-00030                                     |
| <b>Mitigation Location</b>             | SR 5 East of Exit 215, Snohomish County        |
| <b>Township/Range/Section (impact)</b> | T.32N/R.4E/S.14                                |
| <b>Monitoring Period</b>               | 2001 to 2005                                   |
| <b>Year of Monitoring</b>              | 3 of 5   |
| <b>Area of Project Impact</b>          | 0.50 acres                                     |
| <b>Type of Mitigation</b>              | Wetland Enhancement/Creation                   |
| <b>Area of Mitigation</b>              | 0.71 acres                                     |

**Table 12.2 Monitoring Summary for the SR 5 Stanwood/Bryant Mitigation Site**

| <b>Success Standard</b>                                   | <b>2003 Results</b>                |
|---|------------------------------------|
| Maintain a weed-free condition to ensure continued growth | Woody species are well established |

### Success Standard

The success standard for the SR 5 Stanwood/Bryant mitigation site was excerpted from the *SR 5 Stanwood/Bryant Vicinity Weigh Station Conceptual Wetland Mitigation Plan* (Ehinger and Tolon 1997). Appendix K provides the complete text of the success standard for this project.

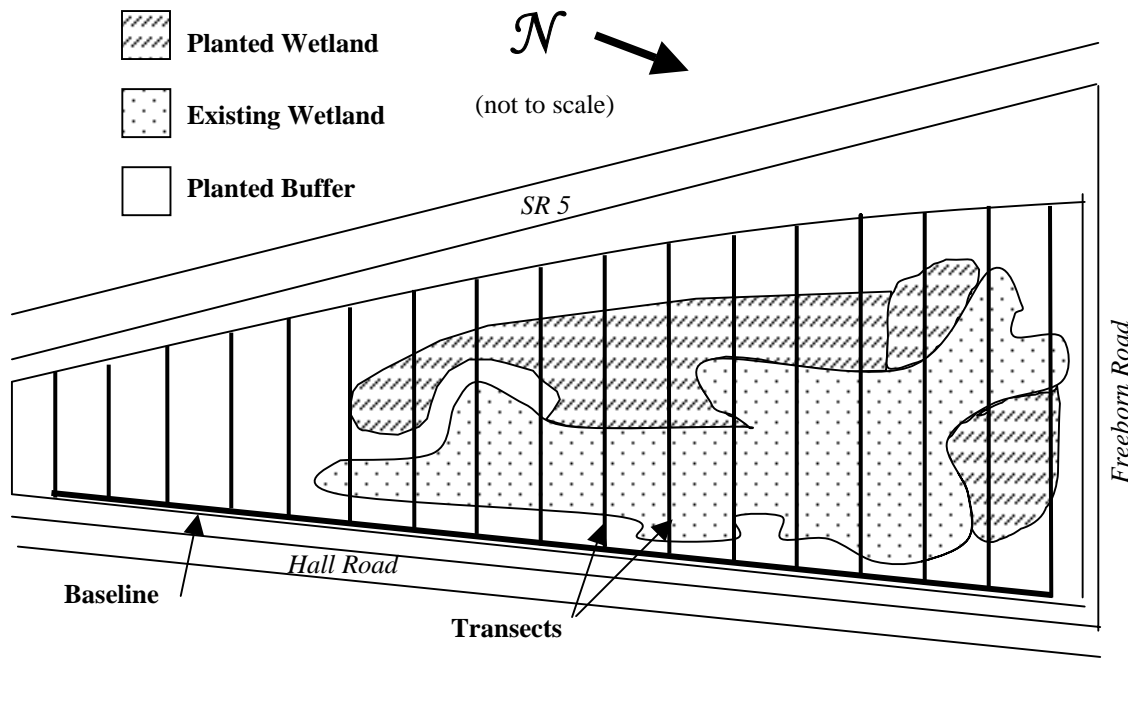
#### Success Standard 1

Maintaining a weed-free condition and irrigation as necessary to ensure continued growth shall be accomplished (2003).

### Methods

A qualitative assessment of planted species and overall site conditions was made to evaluate development of the intended plant community.

In addition, aerial cover of invasive species was measured using 18 temporary transects placed perpendicular to a baseline. (Figure 12.1). Thirty-eight 20-meter point-line sample units (40 points each) were positioned along sampling transects in the planted areas using a systematic random sampling method (Success Standard 1). Twenty-eight 20-meter point-line sample units (40 points each) were positioned in the existing wetland to obtain additional information for possible site management.



**Figure 12.1** SR 5 Stanwood/Bryant Mitigation Site Sampling Design (2003)

Sample size analysis was conducted using the following equation (Elzinga et al 1998).

$$n = \frac{(z)^2 (s)^2}{(B)^2}$$

$z$  = standard normal deviate  
 $s$  = sample standard deviation  
 $B$  = precision level<sup>34</sup>  
 $n$  = unadjusted sample size

For additional details on the methods described above, see the Methods section of this report.

<sup>34</sup> The precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.



## Results and Discussion

### Success Standard 1 – Maintain a Weed-Free Condition to Ensure Continued Growth

Prior to mitigation site construction, the planted areas of this site were monotypic fields of *Phalaris arundinacea* (reed canarygrass) (Ehinger and Tolon 1997). Site enhancement activities included the installation of native trees, shrubs, and emergent plantings. Three years into the monitoring period (2003), a qualitative assessment indicates the site is developing consistent with the objectives of enlarging



**Figure 12.2** SR 5 Stanwood/Bryant Mitigation Site (July 2003)

pre-existing emergent, scrub-shrub, and forested wetlands and enhancing buffer areas. Thirteen of the 14 woody species planted on this site appear to be well established. Aerial cover of the woody plant community is estimated to be 30%, with trees and shrubs beginning to stratify and range from one half to three meters in height (Figure 12.2). Although four of the six-planted emergent species were not observed in the planned emergent areas, two native obligate herbaceous volunteer species have colonized parts of the emergent zone (Table 12.3).

**Table 12.3** Emergent Species Observed at the SR 5 Stanwood/Bryant Mitigation Site in 2003

| Scientific Name               | Common Name           | Planted | Observed |
|-------------------------------|-----------------------|---------|----------|
| <b>Planted Emergent Areas</b> |                       |         |          |
| <i>Argentina anserina</i>     | silverweed cinquefoil |         | X        |
| <i>Carex deweyana</i>         | Dewey sedge           | X       |          |
| <i>Carex obnupta</i>          | slough sedge          | X       | X        |
| <i>Carex stipata</i>          | sawbeak sedge         |         | X        |
| <i>Eleocharis</i> species     | spike-rushes          | X       |          |
| <i>Juncus tenuis</i>          | slender rush          | X       |          |
| <i>Lysichiton americanus</i>  | skunkcabbage          | X       |          |
| <i>Scirpus microcarpus</i>    | small-fruited bulrush | X       | X        |

Aerial cover provided by invasive species in the planted areas (all zones) is estimated to be 17% ( $CI_{80\%} = 14\text{-}19\%$  cover).<sup>35</sup> *Phalaris arundinacea* contributes the majority of this cover and was observed in patches throughout the site. Other invasive species present on the site are *Cirsium* species (thistles), *Cytisus scoparius* (Scot's broom), *Hypericum perforatum* (common St. Johnswort), *Iris pseudacorus* (paleyellow iris), *Leucanthemum vulgare* (oxeye daisy), *P. arundinacea*, and *Rubus* species (blackberries). Though the presence of invasive species does not appear to be interfering with site development at this time, weed control is recommended.

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<sup>35</sup> Estimated values are presented with their corresponding statistical confidence interval. For example, 17% ( $CI_{80\%} = 14\text{-}19\%$  cover) means we are 80% confident that the true aerial cover value is between 14% and 19 percent.

## SR 9 Howell Creek, Snohomish County

The following report summarizes monitoring activities completed by the Washington State Department of Transportation Wetland Assessment and Monitoring Program at the SR 9 Howell Creek mitigation site in July 2003. Monitoring data were obtained to compare to fifth-year success standards. Activities included vegetation surveys of the wetland areas. Table 13.1 provides general site information and Table 13.2 shows this year's monitoring results.

**Table 13.1 General Information for the SR 9 Howell Creek Mitigation Site**

|  |   |
|--|---|
| <b>Contract Name</b>                   | SR 522, SR 9 I/C Modifications-Stage 1A                               |
| <b>Contract Number</b>                 | C4810   |
| <b>USACE NWP Number</b>                | 95-4-01224  |
| <b>Mitigation Location</b>             | SR 9 between SR 522 and 176 <sup>th</sup> Street SE, Snohomish County |
| <b>Township/Range/Section (impact)</b> | T.27N/R.5E/S.34   |
| <b>Monitoring Period</b>               | 1999 to 2003  |
| <b>Year of Monitoring</b>              | 5 of 5  |
| <b>Area of Project Impact</b>          | 1.27 acres  |
| <b>Type of Mitigation</b>              | Creation, Restoration, and Enhancement                                |
| <b>Area of Mitigation</b>              | 2.10 acres  |

**Table 13.2 Monitoring Summary for the SR 9 Howell Creek Mitigation Site**

| <b>Success Standards</b>  | <b>2003 Results<sup>36</sup></b>  |
|---|---|
| 1. $\geq 50\%$ cover of woody species in the forested and scrub-shrub wetland | 80% (CI <sub>90%</sub> = 74-86% cover)  |
| 2. $\geq 80\%$ FAC and wetter herbaceous species in the emergent wetland      | 93% (CI <sub>90%</sub> = 88-98% cover)  |
| 3. $< 15\%$ cover of non-native species in the wetland                        | Forested and scrub-shrub wetland invasives:<br>20% (CI <sub>80%</sub> = 16-25% cover)<br>Emergent invasives: 57% (CI <sub>80%</sub> = 48-65% cover) |
| 4. Presence of scrub-shrub and forested classes                               | Present   |
| 5. In-stream habitat structures will remain in place                          | 9 of 16 habitat structures were observed  |
| 6. Juvenile rearing and overwintering habitat                                 | Not functioning as intended   |

<sup>36</sup> Estimated values are presented with their corresponding statistical confidence interval. For example, 80% (CI<sub>90%</sub> = 74-86% cover) means we are 90% confident that the true aerial cover value is between 74% and 86 percent.

## **Success Standards and Sampling Objectives**

Fifth-year success standards for the SR 9 Howell Creek mitigation site were excerpted from the *SR 9 – SR 522 to Clearview Wetland Mitigation Plan* (WSDOT 1995).

Sampling objectives follow the success standard where appropriate. Appendix L provides the complete text of the success standards for this project.

### Success Standard 1

Cover of woody species will be at least 50% in areas designated forested and scrub-shrub (2003).

#### Sampling Objective 1

To be 80% confident the true aerial cover of woody species in the forested and scrub-shrub area is within 20% of the estimated value.

### Success Standard 2

Cover of emergent species will be at least 80% with predominantly facultative or wetter species (2003).

#### Sampling Objective 2

To be 80% confident the true aerial cover of FAC and wetter herbaceous species in the emergent wetland areas is within 20% of the estimated value.

### Success Standard 3

Non-native species will comprise less than 15% of the wetland vegetation (2003).

#### Sampling Objective 3

To be 80% confident the true aerial cover of non-native invasive species in the wetland is within 20% of the estimated value.

### Success Standard 4

A scrub-shrub vegetation class and forested vegetation class will be identifiable, as determined by the presence of species shown on the planting list and/or recruitment of native scrub-shrub or forest species (2003).

### Success Standard 5

In-stream habitat structures will remain in place at the end of the monitoring period (2003).

### Success Standard 6

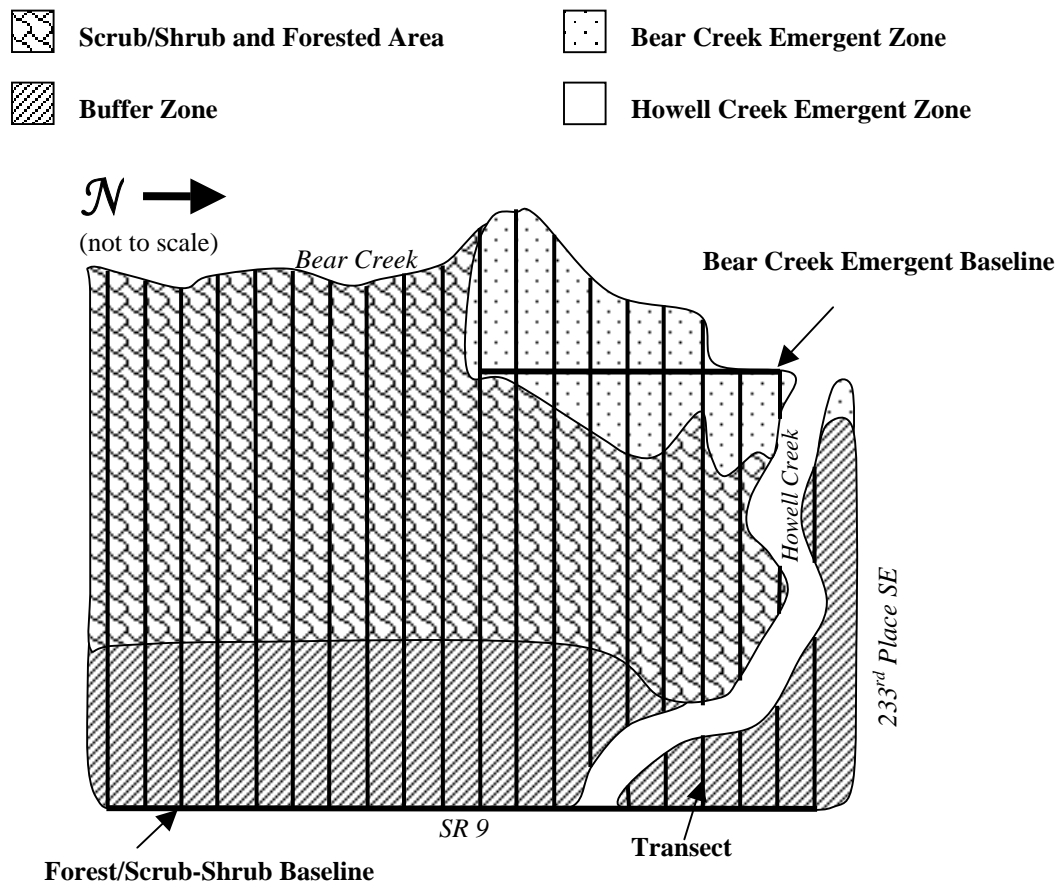
At the conclusion of monitoring, the stream will provide juvenile rearing and overwintering habitat (2003).

## Methods

A baseline was established parallel to SR 9 on the east side of the site to survey the forested and scrub-shrub wetland areas (Figure 13.1). A total of thirty-three temporary sampling transects were placed perpendicular to the baseline using a systematic random sampling method. Twenty-seven 40-meter line-intercept sample units were used to assess woody cover and twenty-two 60-meter point-line sample units (120 points each) were used to assess invasive species cover (Success Standard 1 and 3). These sample units were randomly positioned along the sampling transects.

Herbaceous facultative and wetter and non-native invasive species were surveyed in the Bear Creek emergent zone by placing a secondary baseline parallel to SR 9 (Success Standard 2 and 3) (Figure 13.1). Eleven temporary sampling transects were placed perpendicular to the baseline using a systematic random sampling method. Eighteen 0.5 x 1.0 meter point-frame sample units (30 points each) were randomly positioned along these transects.

Vegetation surveys were conducted in the Howell Creek emergent zone by using a restricted random sampling method to position twenty-six 0.5 x 1.0 meter point-frame sample units (30 points each) throughout the length of the creek. Non-native invasive and facultative and wetter species cover data were collected to address Success Standards 2 and 3.



**Figure 13.1 SR 9 Howell Creek Mitigation Site Sampling Design (2003)**

Sample size analysis was conducted using the following equation.

$$n = \frac{(z)^2 (s)^2}{(B)^2}$$

$z$  = standard normal deviate  
 $s$  = sample standard deviation  
 $B$  = precision level<sup>37</sup>  
 $n$  = unadjusted sample size

General observations were made to assess vegetation classes, in-stream habitat structures, and juvenile rearing and overwintering habitat (Success Standard 4, 5, and 6).

For additional details on the methods described above, see the Methods section of this report.

## Results and Discussion

### Success Standard 1 – At Least 50% Cover of Woody Species in the Forested and Scrub-Shrub Areas

The aerial cover of woody species in the scrub-shrub and forested wetland area was estimated to be 80% (CI<sub>90%</sub> = 74-86% cover). This exceeds the 50% cover requirement (Success Standard 1). Most of this cover is provided by *Salix* species (willows), *Populus balsamifera* (black cottonwood), and *Cornus sericea* (redosier dogwood) on the east portion of the wetland. The west portion of the wetland by Bear Creek has less woody cover due to beaver damage. However, some of the damaged plantings are starting to regenerate.

### Success Standard 2 – At Least 80% Cover of FAC and Wetter Emergent Species

In both of the emergent areas combined, the aerial cover of FAC and wetter herbaceous species was estimated to be 93% (CI<sub>90%</sub> = 88-98% cover). Although this value exceeds the emergent FAC and wetter aerial cover requirement, much of this cover is provided by *Phalaris arundinacea* (reed canarygrass). When *P. arundinacea* and non-native species are excluded from the calculations, the aerial cover of native FAC and wetter herbaceous species is estimated to be 31% (CI<sub>80%</sub> = 24-39% cover) (see Success Standard 3).

### Success Standard 3 – Less than 15% Cover of Non-Native Species in the Wetland

The aerial cover of non-native invasive species in the emergent areas was estimated to be 57% (CI<sub>80%</sub> = 48-65% cover). This is considerably higher than the non-native species threshold of 15 percent (Success Standard 3). *Phalaris arundinacea* provides most of the invasive cover in these emergent zones.

The aerial cover of non-native invasive species in the forested and scrub-shrub wetland area was estimated to be 20% (CI<sub>80%</sub> = 16-25% cover). Although this exceeds the non-native species threshold (Success Standard 3), woody vegetation does not appear to be

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<sup>37</sup> The precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.

affected by these species. Woody vegetation is well developed on this portion of the site and provides 80% aerial cover ( $CI_{90\%} = 74\text{-}86\%$  cover) (see Success Standard 1).

#### Success Standard 4 – Presence of Scrub-Shrub and Forested Vegetation Classes

The twelve woody species on the planting plan and volunteer *Alnus rubra* (red alder) were observed on site (Table 13.4). Shrub height ranged from one and a half meters to two meters tall and trees ranged from two to six meters tall. The dominant tree and shrub species present on the site were *Salix* species (willows). The successful development of these vegetation classes satisfies the requirements of Success Standard 4.

**Table 13.4 Trees and Shrubs Observed at the SR 9 Howell Creek Mitigation Site**

| Scientific Name              | Common Name       | Classification <sup>38</sup> |
|------------------------------|-------------------|------------------------------|
| <i>Acer circinatum</i>       | vine maple        | Shrub                        |
| <i>Alnus rubra</i>           | red alder         | Tree                         |
| <i>Cornus sericea</i>        | redosier dogwood  | Shrub                        |
| <i>Crataegus douglasii</i>   | black hawthorn    | Shrub/Small Tree             |
| <i>Fraxinus latifolia</i>    | Oregon ash        | Tree                         |
| <i>Physocarpus capitatus</i> | Pacific ninebark  | Shrub                        |
| <i>Populus balsamifera</i>   | black cottonwood  | Tree                         |
| <i>Pseudotsuga menziesii</i> | Douglas-fir       | Tree                         |
| <i>Rosa woodsii</i>          | Wood's rose       | Shrub                        |
| <i>Salix</i> species         | willows           | Tree/Shrub                   |
| <i>Sambucus racemosa</i>     | red elderberry    | Shrub                        |
| <i>Thuja plicata</i>         | western red cedar | Tree                         |
| <i>Tsuga heterophylla</i>    | western hemlock   | Tree                         |

#### Success Standard 5 – In-Stream Habitat Structures

According to the Channel Change Plan, 16 woody habitat structures were installed in the creek. Only nine of these structures were observed in 2003. The rest of these woody structures may be buried in recently deposited fine-grained sediment. Since the riparian area is becoming well established with *A. rubra* and *Salix* species, future woody debris recruitment is likely to occur. The recruitment of these species will provide short-term refuge for juvenile salmon and nutrient input (see Success Standard 6).

#### Success Standard 6 – Juvenile Rearing and Overwintering Habitat

Most of the Howell Creek substrate has been covered with sediment. The amount of sediment present throughout the creek ranges up to three decimeters. Installed cobbles, which provide habitat for certain prey like macroinvertebrate species, are still exposed in some of the faster flowing riffles. The silt fence is intact except for a couple areas toward the east end of the creek.

<sup>38</sup> Cooke (1997) was used to determine tree and shrub classification.

Aerial cover provided by woody vegetation in the riparian area was qualitatively estimated to be 95% (Figure 13.2). Trees and shrubs along the riparian corridor may improve juvenile salmonid habitat as they help regulate water temperature and provide a potential future source of large woody debris. Recently fallen *A. rubra* were observed in the creek in October 2003.

Only one of three intended pools was observed along the length of Howell Creek. This pool was present close to the confluence of Howell and Bear Creek. The other pools have filled in with sediment and vegetation. During a site visit in October, the average depth of water throughout the creek was estimated to be approximately two decimeters.

Based on the above observations, the creek does not appear to be functioning as intended.



**Figure 13.2** SR 9 Howell Creek Mitigation Site (July 2003)



## SR 99 Lincoln Way, Snohomish County

The following report summarizes monitoring activities completed by the Washington State Department of Transportation Wetland Assessment and Monitoring Program at the SR 99 Lincoln Way mitigation site in July 2003. Monitoring data were obtained to compare to third-year success standards. Activities include vegetation surveys of the wetland and buffer plant communities. Table 14.1 provides general site information and Table 14.2 summarizes this year's monitoring results.

**Table 14.1 General Information for the SR 99 Lincoln Way Mitigation Site**

|  |   |
|--|---|
| <b>Contract Name</b>                       | SR 525, SR 99 I/C Wetland Mitigation                                      |
| <b>Contract Number</b>                     | C5800   |
| <b>USACE NWP Number</b>                    | 98-4-02126  |
| <b>Mitigation Location</b>                 | North of Lincoln Way, South of 150 <sup>th</sup> Pl. SW, Snohomish County |
| <b>Township/Range/Section</b>              | T.27N/R.4E/S.3,4,10,14 T.28N./R.4E/S.34                                   |
| <b>Monitoring Period</b>                   | 2001 to 2010  |
| <b>Year of Monitoring</b>                  | 3 of 10   |
| <b>Area of Project Impact<sup>39</sup></b> | 1.36 acres  |
| <b>Type of Mitigation</b>                  | Wetland Creation  |
| <b>Area of Mitigation</b>                  | 1.67 acres (see also Manor Way)   |

**Table 14.2 Monitoring Summary for the SR 99 Lincoln Way Mitigation Site**

| <b>Performance Criteria</b>  | <b>2003 Results<sup>40</sup></b>            |
|--|---|
| <b>Success Standards</b>   |   |
| 1. 70% relative aerial cover of native FACW and wetter herbaceous vegetation in the emergent zone      | 70% (CI <sub>80%</sub> = 61-79% cover)      |
| 2. 15% aerial cover by native FAC and wetter woody vegetation in the scrub-shrub and forested wetlands | 12% (CI <sub>80%</sub> = 10-14% cover)      |
| 3. 15% aerial cover by native woody species in the buffer  |   |
| 4. < 10% aerial cover by invasive exotic species   | 1% (CI <sub>80%</sub> = 0-1% cover)         |
| 5. Wetland hydrology   | Observed                                    |
| 6. Habitat structures  | Observed                                    |
| 7. Increase in wildlife cover and forage species for habitat structure                                 | Dense vegetation and seasonal ponds present |
| <b>Permit Requirement</b>  |   |
| 8. Inspect wetland for stranded fish   | None observed                               |

<sup>39</sup> SR 99 Lincoln Way mitigation site provides partial compensation for impacts from the SR 524: (196<sup>th</sup> St./ Filbert Road) 24<sup>th</sup> to SR 527, SR 405: Bothell to Swamp Creek, Stage 2, SR 525: I-5 to SR 99 Widening, SR 525 Swamp Creek park and Ride Extension and SR 525: SR 99 Interchange Project. The SR 99 Manor Way mitigation site provides the remaining compensation for this project.

<sup>40</sup> Estimated values are presented with their corresponding statistical confidence interval. For example, 70% (CI<sub>80%</sub> = 61-79% cover) means we are 80% confident that the true aerial cover value is between 61% and 79 percent.

## **Success Standards and Sampling Objectives**

The third-year success standards listed below were excerpted from the *Manor and Lincoln Way Wetland Mitigation Plan* (WSDOT 1999). Sampling objectives follow success standards, where appropriate. Appendix M provides the complete text of the success standards and the permit requirement for this project.

### Success Standard 1

The emergent zones will have 70% relative areal (*sic*) coverage of facultative-wet or wetter native (i.e., excluding reed canarygrass or purple loosestrife) emergent vegetation, comprised of a minimum of three native species. The scrub-shrub and forested zones combined will have 15% areal (*sic*) cover by native facultative or wetter woody species, comprised of at least three species each (2003).

### Contingency (for Success Standard 1)

If the site does not meet the standards of success for vegetative cover after the third growing season (2003), additional planting will be performed. Sprigs, cuttings, seeds or live plant material as necessary will be replanted and monitored to assure that coverage meets performance standard criteria. If required, remedial grading will occur if the hydrology standard is not met for two years of non-drought conditions.

#### Sampling Objective 1a

To be 80% confident the true relative aerial cover for native facultative-wet and wetter herbaceous vegetation in the emergent wetland is within 20% of the estimated value.

#### Sampling Objective 1b

To be 80% confident the true aerial cover for native facultative and wetter woody vegetation in the scrub-shrub and forested wetlands combined is within 20% of the estimated value.

### Success Standard 2

The buffer will have 15% areal (*sic*) coverage of native woody species (2003).

#### Sampling Objective 2

To be 80% confident the true aerial cover of native woody vegetation in the buffer is within 20% of the estimated value.

### Success Standard 3

Noxious and invasive species identified in Snohomish County's Critical Area Regulation will be eliminated immediately if found occurring on the site, before large populations can establish. A weed control program will be implemented if more than 10% of the wetland is invaded by invasive exotic species (e.g., reed canarygrass or purple loosestrife) (2003).

### Sampling Objective 3

To be 80% confident the true aerial cover of invasive exotic species is within 20% of the estimated cover value.

### Success Standard 4

Water is above, at or near the surface of the land for a minimum of 12.5 percent of the growing season (30 consecutive days from March through October 2003).

### Success Standard 5

Habitat structures identified in the plans are still in place (2003).

### Success Standard 6

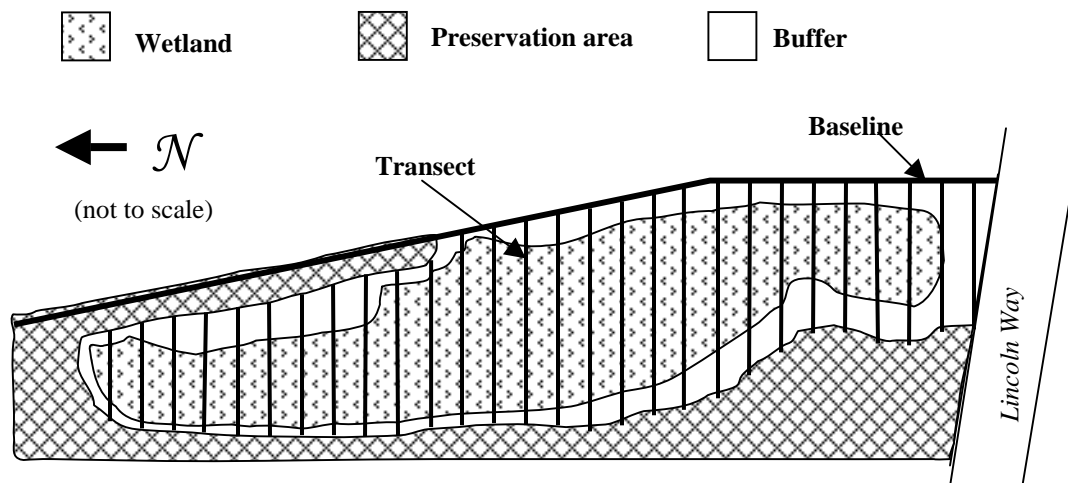
After three years, increases in wildlife cover and forage species will improve habitat structure. This is expected to provide a corresponding increase in wildlife use (2003).

### Permit Requirement (WDFW HPA Permit 00-D7276-02)

The monitoring program shall include inspection for stranded fish during seasons when the wetland is drying up, and at times of year when the water of the wetland approaches 70 degrees Fahrenheit. This monitoring shall be accomplished every year that plant monitoring is conducted. If fish are found to be stranded in wetland pools or other areas of the project at these times, wetland modification to solve the problem shall be proposed by WSDOT and accomplished under a separate HPA. Reports of monitoring for fish shall be forwarded to the appropriate WDFW biologist.

## **Methods**

To evaluate the vegetative community, a baseline was placed on the east side of the site. Thirty temporary sampling transects were placed perpendicular to the baseline using a systematic random sampling method (Figure 14.1).



**Figure 14.1 SR 99 Lincoln Way Mitigation Site Sampling Design (2003)**

The point-intercept method was used to evaluate cover by herbaceous species in the emergent zone (Success Standard 1). Ten-meter sample units (20 points each) were randomly placed on 26 of the sampling transects.

The line-intercept method was used to evaluate cover by woody species (Success Standards 1 and 2). Forty-seven 30-meter sample units were randomly positioned across the scrub-shrub and buffer zones.

To evaluate cover by invasive species (Success Standard 3), the point-intercept method was used. Invasive species were evaluated by randomly positioning thirty-eight 30-meter point-line sample units (60 points each) along sampling transects across the entire site.

Sample size analysis was conducted using the following equation (Elzinga et al. 1998).

$$n = \frac{(z)^2 (s)^2}{(B)^2}$$

$z$  = standard normal deviate  
 $s$  = sample standard deviation  
 $B$  = precision level<sup>41</sup>  
 $n$  = unadjusted sample size

To evaluate wetland hydrology (Success Standard 4), hydrology field indicators were recorded in mid-March and mid-May.

Habitat structures (root wads, stumps with roots, brush piles or nest boxes) were counted (Success Standard 5).

Fish and wildlife observations were made during each site visit (Success Standard 6 and Permit Requirement).

For additional details on the methods described above, see the Methods section of this report.

## Results and Discussion

### Success Standard 1 – 70% Relative Cover by Native FACW & Wetter Vegetation in the Emergent Wetland

The relative cover of native FACW and wetter herbaceous vegetation in the emergent wetland was estimated to be 70% (CI<sub>80%</sub> = 61-79% cover). This value meets the third-year success standard. The emergent zone



**Figure 14.2** SR 99 Lincoln Way (May 2003)

<sup>41</sup> In this equation, the precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.

is comprised of a variety of native FACW and wetter species. Three of the most common species include *Equisetum telmateia* (giant horsetail), *Juncus* species (rushes), and *Typha latifolia* (broadleaf cattail). Figure 14.2 shows cover development near one of the emergent areas.

#### Success Standard 1 and 2 – 15% Cover by Native FAC & Wetter Woody Vegetation in the Scrub-Shrub, Forested Wetland and Buffer

The aerial cover estimate of FAC and wetter native woody vegetation in the scrub-shrub, forested wetland and buffer combined, was estimated to be 12% ( $CI_{80\%}$  = 10-14% cover). This value approaches the third-year standard. Though survival of woody vegetation is satisfactory in most areas, the achievement of future success criteria may require modest replanting, particularly in the northwestern part of the site. Three of the most common native FAC and wetter woody species encountered on the sampling transects include, *Alnus rubra* (red alder), *Cornus sericea* (redosier dogwood) and *Thuja plicata* (western red cedar).

#### Success Standard 3 – Less Than 10% Aerial Cover of Invasive Exotic Species

The mean aerial cover estimate for invasive species was estimated to be 1% ( $CI_{80\%}$  = 0-1% cover). This value is considerably less than the 10% threshold specified by Success Standard 3.<sup>42</sup> Invasive species encountered on sampling transects included *Phalaris arundinacea* (reed canarygrass), *Rubus armeniacus* (Himalayan blackberry), *Rubus laciniatus* (cutleaf blackberry), *Cirsium arvense* (Canada thistle), *Convolvulus arvensis* (field bindweed), and *Cytisus scoparius* (Scotch broom). These species currently do not pose a threat to site development.

#### Success Standard 4 – Wetland Hydrology for 12.5% of the Growing Season

In March 2003, the site appeared to be saturated or inundated across the intended wetland areas. Maximum water depths at this time were three decimeters in the lower pond and two decimeters in the upper pond. By mid-May wetland hydrology was still present to a slightly lesser degree with water levels receded by approximately one decimeter. These observations suggest that water was above, at, or near the surface of the land for a minimum of 12.5% of the growing season (30 consecutive days from March through October) despite recent drought like conditions. An interim delineation is planned for the spring of 2004.

#### Success Standard 5 – Habitat Structures

The habitat structures specified on the planting plan were in place. During the 2003 monitoring visit, six brush piles, eight logs, six stumps, and nine nest boxes were counted.

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<sup>42</sup> A limited list of invasive species was developed from the Snohomish County Invasive/exotic plant species list: *Cirsium vulgare* (bull thistle), *Cirsium arvense* (Canada thistle), *Cytisus scoparius* (Scot's broom), *Dipsacus sylvestris* (Fuller's teasel), *Hypericum perforatum* (common St. Johnswort), *Tanacetum vulgare* (common tansy), *Lythrum salicaria* (purple loosestrife), *Phalaris arundinacea* (reed canarygrass), *Polygonum cuspidatum* (Japanese knotweed), *Rubus armeniacus* (Himalayan blackberry), and *Rubus laciniatus* (evergreen blackberry).

#### Success Standard 6 – Increase in Wildlife Cover and Forage Species for Habitat Structure

According to Cooke (1997), the following woody species observed on the site provide potential sources of cover and fruit or seeds for birds and/or other wildlife: *Acer macrophyllum* (bigleaf maple), *C. sericea*, *Lonicera involucrata* (twinberry), *Mahonia aquifolium* (tall Oregon grape), *Rubus* species (blackberries) (are non-native, but are still a potential source of fruit and seeds for birds and/or other wildlife), *Rubus spectabilis* (salmonberry), *Salix* species (willows), and *Sambucus racemosa* (red elderberry). The presence of fruit-bearing shrubs and habitat structures has increased habitat complexity and structure providing the opportunity for birds, small mammals, and amphibians to use the site. Twenty-three bird species from 15 avian families have been found using the site. The WDFW priority species, Band-tailed Pigeon (*Patagioenas fasciata*), was observed on site in 2003. One of the limiting factors for this species is availability of berry, fruit, and nut-producing shrubs and trees (Lewis et al. 2003). Also in 2003, a Northern Flicker (*Colaptes auratus*) pair successfully bred in one of the nest boxes. Pacific Chorus Frogs (*Pseudacris regilla*) were observed on site throughout the monitoring period. These observations indicate that the site is developing important wildlife cover, structural diversity, and is hosting a variety of wetland wildlife species, thus satisfying Success Standard 6.

#### Permit Requirement – Inspect Wetland for Stranded Fish

Stranded fish were not observed during monitoring site visits in spring and summer.

## SR 99 Manor Way, Snohomish County

The following report summarizes monitoring activities completed by the Washington State Department of Transportation Wetland Assessment and Monitoring Program at the SR 99 Manor Way mitigation site in July 2003. Monitoring data were obtained to compare to third-year success standards. Activities include vegetation surveys of the wetland and buffer plant communities. Table 15.1 provides general site information and Table 15.2 summarizes this year's monitoring results.

**Table 15.1 General Information for the SR 99 Manor Way Mitigation Site**

|  |   |
|--|---|
| <b>Contract Name</b>                       | SR 525, SR 99 I/C Wetland Mitigation    |
| <b>Contract Number</b>                     | C5800                                   |
| <b>USACE NWP Number</b>                    | 98-4-02126                              |
| <b>WDFW HPA Permit</b>                     | 00-D7276-02                             |
| <b>Mitigation Location</b>                 | East of Manor Way, Snohomish County     |
| <b>Township/Range/Section</b>              | T.27N/R.4E/S.3,4,10,14 T.28N./R.4E/S.34 |
| <b>Monitoring Period</b>                   | 2001 to 2010                            |
| <b>Year of Monitoring</b>                  | 3 of 10                                 |
| <b>Area of Project Impact<sup>43</sup></b> | 1.36 acres                              |
| <b>Type of Mitigation</b>                  | Wetland Creation                        |
| <b>Area of Mitigation</b>                  | 1.29 acres (also see Lincoln Way)       |

**Table 15.2 Monitoring Summary for the SR 99 Manor Way Mitigation Site**

| <b>Performance Criteria</b>  | <b>2003 Results<sup>44</sup></b>            |
|--|---|
| <b>Success Standards</b>   |   |
| 1. 70% relative aerial cover of native FACW and wetter herbaceous vegetation in the emergent zone      | 37% (CI <sub>80%</sub> = 30-44% cover)      |
| 2. 15% aerial cover by native FAC and wetter woody vegetation in the scrub-shrub and forested wetlands | 22% (CI <sub>80%</sub> = 16-27% cover)      |
| 3. 15% aerial cover by native woody species in the buffer  | 29% (CI <sub>80%</sub> = 21-37% cover)      |
| 4. <10% aerial cover by invasive exotic species  | 4% (CI <sub>80%</sub> = 2-6% cover)         |
| 5. Wetland Hydrology   | Present                                     |
| 6. Habitat Structures  | Present                                     |
| 7. Increase in wildlife cover and forage species for habitat structure                                 | Dense vegetation and seasonal ponds present |
| <b>Permit Requirement</b>  |   |
| 8. Inspect wetland for stranded fish   | None observed                               |

<sup>43</sup> SR 99 Manor Way mitigation site provides partial compensation for impacts from the SR 524: (196<sup>th</sup> St./ Filbert Road) 24<sup>th</sup> to SR 527, SR 405: Bothell to Swamp Creek, Stage 2, SR 525: I-5 to SR 99 Widening , SR 525 Swamp Creek park and Ride Extension and SR 525: SR 99 Interchange Project. The SR 99 Lincoln Way mitigation site provides the remaining compensation for this project.

<sup>44</sup> Estimated values are presented with their corresponding statistical confidence interval. For example, 37% (CI<sub>80%</sub> = 30-44% cover) means we are 80% confident that the true aerial cover value is between 30% and 44 percent.

## **Success Standards and Sampling Objectives**

The third-year success standards listed below were excerpted from the *Manor and Lincoln Way Wetland Mitigation Plan* (WSDOT 1999). Sampling objectives follow success standards, where appropriate. Appendix M provides the complete text of the success standards and the permit requirement for this project.

### Success Standard 1

The emergent zones will have 70% relative areal (*sic*) coverage of facultative-wet or wetter native (i.e., excluding reed canarygrass or purple loosestrife) emergent vegetation, comprised of a minimum of three native species. The scrub-shrub and forested zones combined will have 15% areal (*sic*) cover by native facultative or wetter woody species, comprised of at least three species each (2003).

### Contingency (for Success Standard 1)

If the site does not meet the standards of success for vegetative cover after the third growing season, additional planting will be performed. Sprigs, cuttings, seeds or live plant material as necessary will be replanted and monitored to assure that coverage meets performance standard criteria. If required, remedial grading will occur if the hydrology standard is not met for two years of non-drought conditions.

#### Sampling Objective 1a

To be 80% confident the true relative aerial cover for native facultative-wet and wetter herbaceous vegetation in the emergent wetland is within 20% of the estimated value.

#### Sampling Objective 1b

To be 80% confident the true aerial cover for native facultative and wetter woody vegetation in the scrub-shrub and forested wetlands combined is within 20% of the estimated value.

### Success Standard 2

The buffer will have 15% areal (*sic*) coverage of native woody species (2003).

#### Sampling Objective 2

To be 80% confident the true aerial cover of native woody vegetation in the buffer is within 20% of the estimated value.

### Success Standard 3

Noxious and invasive species identified in Snohomish County's Critical Area Regulation will be eliminated immediately if found occurring on the site, before large populations can establish. A weed control program will be implemented if more than 10% of the wetland is invaded by invasive exotic species (e.g., reed canarygrass or purple loosestrife) (2003).

#### Sampling Objective 3

To be 80% confident the true aerial cover of invasive species is within 20% of the estimated cover value.



#### Success Standard 4

Water is above, at or near the surface of the land for a minimum of 12.5 percent of the growing season (30 consecutive days from March through October 2003).

#### Success Standard 5

Habitat structures identified in the plans are still in place (2003).

#### Success Standard 6

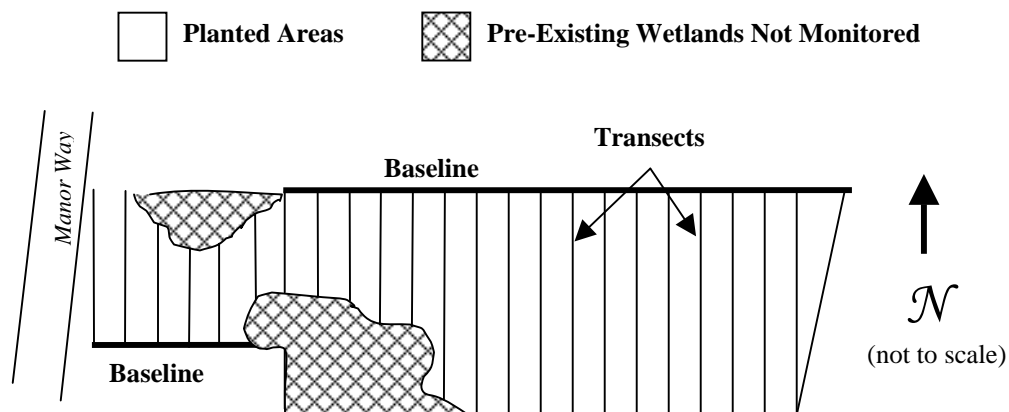
After three years, increases in wildlife cover and forage species will improve habitat structure. This is expected to provide a corresponding increase in wildlife use (2003).

#### Permit Requirement (WDFW HPA Permit 00-D7276-02)

The monitoring program shall include inspection for stranded fish during seasons when the wetland is drying up, and at times of year when the water of the wetland approaches 70 degrees Fahrenheit. This monitoring shall be accomplished every year that plant monitoring is conducted. If fish are found to be stranded in wetland pools or other areas of the project at these times, wetland modification to solve the problem shall be proposed by WSDOT and accomplished under a separate HPA. Reports of monitoring for fish shall be forwarded to the appropriate WDFW biologist.

### **Methods**

To evaluate the vegetative community, a split baseline was placed on the north and south sides of the site. Twenty-eight temporary sampling transects were placed perpendicular to the baselines using a systematic random sampling method (Figure 15.1). The pre-existing wetland was not planted or monitored.



**Figure 15.1 SR 99 Manor Way Mitigation Site Sampling Design (2003)**

The point-line method was used to evaluate cover by herbaceous species in the emergent zone (Success Standard 1a). Fifty-seven point-frame sample units (30 points each) were randomly positioned along the transects.

The line-intercept method was used to evaluate cover by native woody species (Success Standards 1b and 2) in wetland and upland zones. Thirty 15-meter sample units were randomly positioned in each of the two zones.

To evaluate cover by invasive species (Success Standard 3), the point-line method was used. Invasive species were evaluated by randomly positioning seventy-three 15-meter point-line sample units (30 points each) along sampling transects.

Sample size analysis was conducted using the following equation (Elzinga et al. 1998).

$$n = \frac{(z)^2 (s)^2}{(B)^2}$$

$z$  = standard normal deviate  
 $s$  = sample standard deviation  
 $B$  = precision level<sup>45</sup>  
 $n$  = unadjusted sample size

To evaluate wetland hydrology for Success Standard 4, hydrology field indicators were recorded in mid-March and mid-May.

Habitat structures (root wads, stumps with roots, brush piles or nest boxes) were counted (Success Standard 5).

Wildlife observations were made during each site visit (Success Standard 6).

To evaluate the permit requirement, wetland pools were observed for stranded fish during site visits.

For additional details on the methods described above, see the Methods section of this report.

## Results and Discussion

### Success Standard 1a – 70% Relative Cover by Native FACW & Wetter Species in the Emergent Wetland

The relative cover estimate for FACW and wetter native herbaceous vegetation in the emergent wetland is 37% (CI<sub>80%</sub> = 30-44% cover). This value does not approach the third-year success standard. Despite the contingency specifying re-planting, it may not be necessary at this time. Herbaceous communities tend to respond fairly rapidly to changes in hydrology. The relative cover by native FACW and wetter species in the emergent wetland may increase if wetter conditions develop in the 2004 growing season. The three most common FACW and wetter native herbaceous species in the emergent

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<sup>45</sup> In this equation, the precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.

wetland are *Carex stipata* (sawbeak sedge), *Juncus* species (rushes), and *Scirpus* species (bulrushes).

#### Success Standard 1b – 15% Cover by Native FAC & Wetter Woody Species in the Scrub-Shrub and Forested Wetland

The aerial cover estimate for FAC and wetter native woody vegetation in the scrub-shrub and forested wetland is 22% ( $CI_{80\%} = 16\text{-}27\%$  cover). This value exceeds the third-year success standard. Both planted and naturally occurring woody plants have become established in this zone. The three most common native FAC and wetter woody species encountered on the sampling transects are *Cornus sericea* (redosier dogwood), *Rubus spectabilis* (salmonberry), and *Salix sitchensis* (Sitka willow). Cover of planted species in the scrub-shrub and forested wetland has been augmented by patches of volunteer *Alnus rubra* (red alder). In general, the average height of *A. rubra* exceeds the average height of planted species (less than one meter).



**Figure 15.2** SR 99 Manor Way (July 2003)

#### Success Standard 2 – 15% Cover of Native Woody Vegetation in the Buffer

The aerial cover of native woody vegetation in the buffer was estimated to be 29% ( $CI_{80\%} = 21\text{-}37\%$  cover). This value exceeds the third-year success standard. The buffer zone is characterized by a variety of both planted and naturally occurring woody plants. Planted *Salix* species (willows), and *Thuja plicata* (western red cedar) can be seen in the foreground of Figure 15.2. The most common native woody species present in the buffer are *Acer circinatum* (vine maple), *A. rubra*, *Salix* species, and *T. plicata*. As with the wetland, the buffer is being colonized by *A. rubra*.

#### Success Standard 3 – Less Than 10% Aerial Cover of Invasive Exotic Species

The mean aerial cover estimate for invasive species is 4% ( $CI_{80\%} = 2\text{-}6\%$  cover). This value is less than the 10% maximum specified by Success Standard 3.<sup>46</sup> *Phalaris arundinacea* (reed canarygrass) has colonized the emergent zone. *Rubus armeniacus* (Himalayan blackberry), and *Rubus laciniatus* (cutleaf blackberry) are present mostly along the south and east sides of the site. These species currently do not pose a threat to site development.

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<sup>46</sup> A limited list of invasive species was developed from the Snohomish County Invasive/exotic plant species list: *Cirsium vulgare* (bull thistle), *Cirsium arvense* (Canada thistle), *Cytisus scoparius* (Scot's broom), *Dipsacus sylvestris* (Fuller's teasel), *Hypericum perforatum* (common St. Johnswort), *Tanacetum vulgare* (common tansy), *Lythrum salicaria* (purple loosestrife), *Phalaris arundinacea* (reed canarygrass), *Polygonum cuspidatum* (Japanese knotweed), *Rubus armeniacus* (Himalayan blackberry), and *Rubus laciniatus* (evergreen blackberry).

#### Success Standard 4 – Wetland Hydrology for 12.5% of the Growing Season

Areas of inundation or saturation were observed across all emergent zones in mid-March. In mid-May, a smaller portion of this same area was saturated to the surface. These observations suggest that water was above, at or near the surface of the ground for a minimum of 12.5% of the 2003 growing season (30 consecutive days from March through October). An interim delineation is planned for the spring of 2004.

#### Success Standard 5 – Habitat Structures

The habitat structures specified on the planting plan were in place.

#### Success Standard 6 – Increase in Wildlife Cover and Forage Species for Habitat Structure

The following woody species observed on site provide potential sources of cover and fruit or seeds for birds and/or wildlife: *Acer circinatum*, *C. sericea*, *Corylus cornuta* (beaked hazelnut), *Frangula purshiana* (Pursh's buckthorn), *Lonicera involucrata* (twinberry), *Mahonia aquifolium* (tall Oregon grape), *Oemleria cerasiformis* (Indian plum), *Prunus emarginata* (bitter cherry), *Rosa* species (roses), *R. spectabilis*, *Salix* species, and *Sambucus racemosa* (red elderberry).

The presence of fruit-bearing shrubs and habitat structures has increased habitat complexity and structure providing the opportunity for birds, small mammals, and amphibians to use the site. Twenty-three species of birds from 14 avian families were observed on site. Of these 23 bird species, one species, the Red-winged Blackbird (*Agelaius phoeniceus*) is wetland-dependent and two species, the Black-capped Chickadee (*Poecile atricapillus*) and Violet-green Swallow (*Tachycineta thalassina*), are wetland-associated.<sup>47</sup> Other wetland-related wildlife, including Long-toed Salamanders (*Ambystoma macrodactylum*) and Pacific Chorus Frogs (*Pseudacris regilla*) were present during site visits. These observations indicate that the site is developing important wildlife cover, and is currently host to a variety of wetland wildlife species, thus satisfying Success Standard 6.

#### Permit Requirement – Inspect Wetland for Stranded Fish

Stranded fish were not observed during monitoring site visits in spring and summer.

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<sup>47</sup> Birds are assigned a wetland-dependent or wetland-associated species status based on the classification scheme presented in Brown and Smith (1998). Additional references used to further classify bird species include Thomas (1979), Ehrlich et al. (1988), and Smith et al. (1997).

## **Appendices**

## Appendix A

### SR 18 Frog Pond Success Standards

The following excerpt is from the *SR 18 312<sup>th</sup> Way to 304<sup>th</sup> Street Interchange Wetland Mitigation and Monitoring Plan* (Brown 1995). The standards and contingency plans addressed this year are identified in **bold** font.

#### GOALS

The goal of the SR 18, 304<sup>th</sup> Interchange wetland mitigation project is to enhance and thereby create a wetland system comprised of forested, scrub-shrub, emergent and open water elements. In general, the enhanced wetland, wetland buffer, and riparian buffer are expected to provide the following functions and values; wildlife habitat (including amphibian), food chain support, water storage and attenuation, and sediment and nutrient trapping.

#### Objectives and Performance Standards

The following objectives and performance standards establish specific criteria that will be used by WSDOT to measure the mitigation site's success.

##### Objective 1 – Vegetation

The vegetation planted will provide value as food chain support, as well as the functions of flood attenuation, and sediment and nutrient trapping as compared to existing site conditions.

##### Performance Standards

###### After 3 years:

- 1a. The forested wetland should have 70% viability of planted species or be supplemented by natural recruitment of native facultative or wetter native wetland species.
- 1b. The wetland should have 50% areal coverage of forested and scrub-shrub species.

###### After 5 years:

- 1c. **The wetland should have 80% areal cover of forested and scrub-shrub wetland vegetation.**

## Objective 2 – Wildlife

Wildlife habitat diversity will be increased by additions of native species plantings and from the combination of the establishment of early seral vegetation with the more mature forested vegetation existing at the site. The addition of stumps, logs, and brush piles will increase habitat diversity and structure. The wetland will change over time from a largely grassy/emergent area to a wetland dominated by woody vegetation. Overall, the enhancement to a forested/scrub-shrub wetland adjacent to the pond and stream will function to increase the value of the habitat by providing additional feeding, breeding, and resting habitat for birds, small mammals, and amphibians. Implementation of the mitigation plan will result in the increase in habitat and the edge between habitat types.

### Performance Standards

#### **After 3 years:**

- a. The forested wetland, wetland buffer, and riparian buffer should have 70% viability of planted tree and shrub species;
- b. There will be at least twelve habitat structures (logs, stumps, snags, brush piles) within the boundary of the enhanced wetland. These structures will provide perches, cover, and habitat diversity as the planted vegetation matures.

#### **After 5 years:**

- c. **Habitat structure will change from a single layer of vegetation to multiple layers over time as trees and shrubs mature. Differences in height between shrub and tree layers will be observed.**
- d. **The mitigation site should have 80% areal cover of trees and shrubs.**

## Objective 3 – Buffers

There will be approximately 0.68 hectare (1.7 acre) of forested wetland buffer surrounding the created wetland.

#### **After 3 years:**

- a. Upland and riparian forested buffer areas should have 50% cover by forested species planted, or be supplemented or replaced by a native naturally colonizing upland forested plant community at 50% or greater cover.

#### **After 5 years:**

- b. **Upland and riparian forested buffer areas should have 75% cover by forested buffer species planted, or be supplemented or replaced by a**

**native naturally colonizing upland forested plant community at 75% or greater cover.**

#### **Objective 4 – Preservation**

All areas proposed for preservation will be maintained in permanent state ownership by WSDOT and will be so labeled on R/W plan sheets on file at WSDOT.

#### **CONTINGENCY PLANS**

**The mitigation plan is designed to utilize and promote the growth of native vegetation. Attempts will be made to limit the spread of exotic species and they will not be allowed to dominate the site. Noxious weeds, such as purple loosestrife will be eliminated immediately if found occurring on the site, before large populations can establish. A weed control program will be implemented if more than 10% of the wetland is invaded by invasive exotic species.**



## Appendix B

### SR 18 Holder Creek 1 Success Standards

The following excerpt is from the *Issaquah-Hobart Interchange Supplemental Wetland Mitigation Site 2 Mitigation and Monitoring Plan* (WSDOT 1996). The standards addressed this year are in **bold** font.

#### Goals

The goal of the SR 18 Holder Creek wetland mitigation project is to create a surface water depressional wetland, similar to others in the project vicinity, as was Wetland AA. The created wetland will be 2.16 acres of scrub-shrub, with a 3.87 acre forested buffer as mitigation for impacts to 0.82 acres of wetland. In general, the created wetland and wetland buffer are expected to provide the following functions and values: wildlife habitat, food chain support, water storage and attenuation, and sediment and nutrient trapping.

Plantings will occur in three zones;

The Barrier/Buffer Zone (3.87 acre), principally contains facultative and facultative upland plants. These species may eventually seed into the wetland, increasing species diversity over time.

Scrub-Shrub Zone 1 (0.49 acre), this is planned to be an early successional wetland that could transition into a forested wetland over time. Plantings were selected for their ability to tolerate a range of hydrologic conditions, wildlife value and rapid growth.

Scrub-Shrub Zone 2 (1.68 acre), plantings are located in the wettest portion of the created wetland, below the elevation 501 contour. This low point will be the last area to dry out during the season.

An emergent planting area containing rushes, grasses and sedges is not part of this plan because emergent meadow type wetlands are not generally characteristic of this area.

#### Objectives and Performance Standards

The following objectives and performance standards establish specific criteria that will be used by WSDOT to measure the mitigation site's success.

##### Objective 1 – Vegetation

The mitigation site will include 0.4 acres of forested wetland, 2.16 acres of wetland buffer and 1.25 acres of riparian buffer along Holder Creek. The vegetation planted will provide value as food chain support, as well as the functions of flood attenuation, and sediment and nutrient trapping as compared to existing site conditions.

## **Performance Standards**

### **After 3 years:**

- 1a. The wetland should have 70% viability of planted species or be supplemented by natural recruitment of native facultative or wetter native wetland species.
- 1b. The wetland should have 50% areal coverage of forested and scrub-shrub species.

### **After 5 years:**

- 1c. The wetland should have 80% areal cover of forested and scrub-shrub wetland vegetation.**

## **Objective 2 – Wildlife**

Wildlife habitat diversity will be increased by additions of native species plantings and from the combination of the establishment of early seral vegetation with the more mature forested vegetation existing at the site. The addition of stumps, logs, and brush piles will increase habitat diversity and structure in the newly vegetation areas. The created wetland should change over time from a largely bare area to a wetland dominated by woody vegetation. Overall, the creation of the scrub-shrub wetland and it's forested buffer adjacent to Holder Creek stream corridor will function to increase the value of the existing riparian habitat by providing additional feeding, breeding, and resting habitat for birds, and mammals. The mitigation site also assists in extending the vegetated corridor available for wildlife movement along Holder Creek. Implementation of the mitigation plan will result in the inverse in habitat and the edge between habitat types.

## **Performance Standards**

### **After 3 years:**

- 2a. The wetland buffer should have 70% viability of planted tree and shrub species;
- 2b. There will be at least three habitat structures (logs, stumps, snags, brush piles) within the boundary of the created wetland and at least six within the buffer area. These structures will provide perches, cover, and habitat diversity as the planted vegetation matures.

### **After 5 years:**

- 2d. Habitat structure will change from a single layer of vegetation to multiple layers over time as trees and shrubs mature. Differences in height between shrub and tree layers will be observed.**

- 2e. The mitigation site should have 80% areal cover of trees and shrubs.

### Objective 3 – Buffers

There will be 2.24 acres of forested wetland buffer surrounding the created wetland. In addition to this there will be 2.32 acres of riparian buffer replaced along Holder Creek.

#### After 3 years:

- 3a. Upland and riparian forested buffer areas should have 50% cover by forested species planted, or be supplemented or replaced by a native naturally colonizing upland forested plant community at 50% or greater cover.

#### After 5 years:

- 3b. Upland and riparian forested buffer areas should have 75% cover by forested buffer species planted, or be supplemented or replaced by a native naturally colonizing upland forested plant community at 75% or greater cover.

### Objective 4 – Preservation

All areas proposed for preservation will be maintained in permanent state ownership by WSDOT and will be so labeled on R/W plan sheets on file at WSDOT.

### CONTINGENCY PLANS

1. If the coverage of trees is less than 50% after the third growing season these species will be replanted. Sprigs, cuttings, seeds or live plant material will be replanted and monitored to assure that coverage meets performance standard criteria. Remedial work may occur if hydrology is not sufficient to support wetland vegetation.
2. If aerial coverage of wetland plants is less than 50% after the fourth year, resource agencies will be consulted for advice on further measures to remedy the problems at the site. The monitoring program will be extended and such reasonable measures will be performed as are necessary to establish appropriate wetland vegetation. WSDOT will perform all reasonable measures considered necessary to establish and maintain a functioning wetland system.
3. **The mitigation plan is designed to utilize and promote the growth of native vegetation. Attempts will be made to limit the spread of exotic species and they will not be allowed to dominate the site. Noxious weeds, such as purple loosestrife will be eliminated immediately if found occurring on the site, before large populations can establish. A weed control program will be implemented if more than 10% of the wetland is invaded by invasive exotic species.**

## Appendix C

### SR 18 Holder Creek 2 Success Standards

#### Success Standards

The following excerpt is from the SR 18 Holder Creek Vicinity Slope Stabilization Sensitive Area Mitigation Plan (Mesich and Steinmetz 2000). Additional permit requirements are excerpted from U. S. Army Corps of Engineers NWP 98-4-02323. The standards addressed this year are identified in **bold** font. Other standards will be addressed in the indicated monitoring year.

#### OBJECTIVES AND STANDARDS OF SUCCESS

##### **Objective: Wetland Vegetation**

Mitigation will restore the existing wetland on site.

##### **First-Year**

- Plant establishment will be assessed, and all dead or inadequately planted species will be replaced.
- **Non-native invasive plants shall not make up more than 10% of cover in any growing season.**

##### **Third-Year**

- Shrub cover shall be greater than 30% in third year.

##### **Fifth-Year**

- Plant establishment will be assessed, and all dead or inadequately planted species will be replaced to ensure an 80% survival rate of planted species.
- Shrub cover shall be greater than 50% in the fifth year.
- Non-native invasive plants shall not make up more than 10% of cover in any growing season.

##### **Objective: Buffer Vegetation**

Mitigation will restore sensitive area buffering.

##### **First-Year**

- Plant establishment will be assessed, and all dead or inadequately planted species will be replaced.

##### **Third-Year**

- Shrub cover shall be greater than 30% in the third year.

##### **Fifth-Year**

- Plant establishment will be assessed, and all dead or inadequately planted species will be replaced to ensure an 80% survival rate of planted species.
- Shrub cover shall be greater than 50% in the fifth year.

- Non-native invasive plants shall not make up more than 10% of cover in any growing season.

## MONITORING

The mitigation site will be monitored in the third and fifth years over a period of five years. Monitoring will be in accordance with WSDOT protocol. Monitoring and tracking all WSDOT mitigation projects are completed under Sections 404/410 of the Clean Air Act, for determining compliance with permits, and for meeting requirements specified by local governments in implementation of the Growth Management Act.

WSDOT monitoring conducts its monitoring program from May through September. Monitoring reports are completed annually and submitted to the U.S. Army Corps of Engineers, Washington Department of Ecology, and this case local jurisdiction King County DDES.

### **From King County Clearing and Grading Permit LL CG504 (p. 37-38)**

A five year monitoring plan for stream and/or wetland mitigation shall commence upon implementation of the mitigation plan. Yearly monitoring reports shall be submitted to DDES for review and comment. If the mitigation goals and objectives are not met at the end of the monitoring period, the Engineer will be responsible for the preparation and completion of a contingency plan to remedy the situation. The Engineer shall request, in writing, and inspection from DDES upon final implementation of the mitigation plan by the construction office. The Engineer will monitor the site for a period of 5 years to ensure survival of the plant material, control of erosion and control of non-native plant species. At the end of 5 years, the following performance standards will be met:

- 80% of each species of the required vegetation will have survived.
- **Shrub cover shall be greater than 10% after one year**, greater than 30% after two years and greater than 50% after three years.
- **Non-native invasive plants shall not make up more than 10% of cover in any growing season.**
- **All erosion features, rills, slumps, and gullies shall be repaired immediately with temporary measures and replanted within the planting timelines set out in the special provisions of the mitigation plan.**
- Monitoring reports shall be submitted to King County DDES by October 31 each year of the monitoring period. The monitoring reports shall consist of the following:

**A calculation indicating percent shrub cover over the entire site:**

The following equation provides an estimate for aerial cover ( $\bar{y}$ ) of shrubs and trees across the mitigation site.

$$\bar{y} = \frac{1}{n}(y_1 + y_2 + \dots + y_n) = \frac{1}{n} \sum_{i=1}^n y_i$$

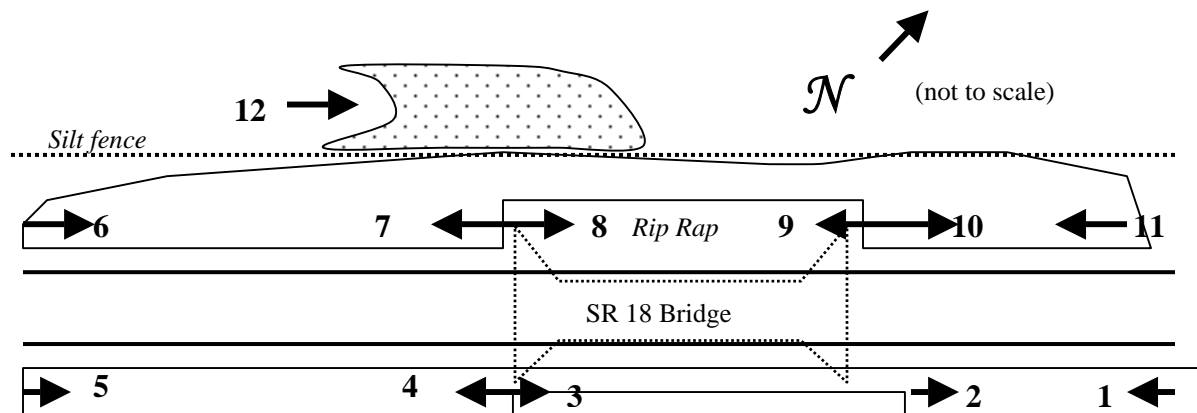
$n$  = sample size (number of sample units)  
 $\bar{y}$  = sample mean (estimated aerial cover)

$$\bar{y} = \frac{1}{47}(3.5) = 0.074 = 7\% \text{ aerial cover}$$

Raw data is available on request.

**Identification of maintenance concerns:** Erosion features, rills, slumps, and gullies were not observed.

**At least twelve original 4 x 6 original color photographs that show the entire planting site, taken from photo points drawn on a map of the planting area and keyed to lines of sight from those photo-points.**



**Figure 16.1 SR 18 Holder Creek 2 Sketch with Photograph Locations**



**Figure 16.3 Photo Point 2**



**Figure 16.2 Photo Point 1**





**Figure 16.4 Photo Point 3**



**Figure 16.5 Photo Point 4**





**Figure 16.6** Photo Point 5



**Figure 16.7** Photo Point 6





**Figure 16.8 Photo Point 7**



**Figure 16.9 Photo Point 8**





**Figure 16.10 Photo Point 9**



**Figure 16.11 Photo Point 10**





**Figure 16.12 Photo Point 11**



**Figure 16.13 Photo Point 12**

## Appendix D

### SR 18 Kendal 1 Success Standards

The following excerpt is from the *SR 18 SE 304th Street to Covington Way Wetland Mitigation Plan* (Davis 1994). The standards addressed this year are identified in **bold** font. Other standards have been addressed in the indicated monitoring year.

#### Goals, Objectives and Standards of Success

The goals for the SR 18 SE 304<sup>th</sup> Street to Covington Way wetland mitigation project is create and enhance forested scrub-shrub wetland and buffer as in-kind mitigation for impacts to 0.7 ha (1.77 ac) wetland and 0.82 ha (2.05 ac) of buffer. In general, the created wetland, wetland buffer, and riparian buffer are expected to provide the following functions: fish and wildlife habitat, food chain support, water storage and attenuation, and sediment and nutrient trapping.

#### Objective #1 – Vegetation

The mitigation sites will include 2.57 ha (6.43 ac) of forested and scrub-shrub wetland and 1 ha (2.5 ac) of wetland buffer. The vegetation planted will provide value as food-chain support, as well as the functions of flood attenuation, and sediment and nutrient trapping as compared to existing site conditions. The riparian vegetation planted along Big Soos Creek will assist in protection and enhancement of in-stream habitat. As this vegetation matures, it will assist in providing shade, winter cover, and recruitment of large organic debris that will be available to enhance in-stream habitat.

#### Performance Standards:

After three years:

- The forested wetland should have 70% viability of planted species or be supplemented by natural recruitment of native facultative or wetter native wetland species.
- The wetland should have 50% areal coverage of forested and scrub-shrub species.

After five years:

- **The wetland should have 80% areal cover of forested and scrub-shrub wetland vegetation.**

#### Objective #2 - Wildlife

Wildlife habitat diversity will be increased by additions of native species plantings and from the combination of the establishment of early seral vegetation with more the mature forested vegetation existing at the site. The addition of stumps, logs, and brush piles will increase habitat diversity and structure in the newly vegetated areas. **Overall, the creation of a forested wetland adjacent to Big Soos Creek will function to increase the value of the existing riparian habitat by providing additional feeding, breeding,**

**and resting habitat for birds, small mammals, and amphibians.** The mitigation plan also assists in extending the vegetated corridor available for wildlife movement along Big Soos Creek. Implementation of the mitigation plan will result in the increase in habitat and edge between habitat types.

#### Performance Standards:

After three years:

- The forested wetland, wetland buffer, and riparian buffer should have 70% viability of planted tree and shrub species.
- There will be at least four habitat structures (logs, stumps, snags, brush piles) within the boundary of the wetland mitigation site at SR 18 and five habitat structures (logs, stumps, snags, brush piles) within boundary of the wetland mitigation site at SR 516. These structures will provide perches, cover, and habitat diversity as the planted vegetation matures.

After five years:

- **Habitat structure will change from a single layer of vegetation to multiple layers over time as trees and shrubs mature. Differences in height between shrub and tree layers will be observed.**
- **The mitigation site should have 80% areal cover of trees and shrubs.**

#### **Objective #3 - Buffers**

There will be 0.77 ha (1.91 ac) of forested and scrub-shrub wetland buffer surrounding the created wetland at SR 18 and 0.23 ha (0.58 ac) of forested and scrub-shrub wetland buffer surrounding the created wetland at SR 516.

#### Performance Standard:

After three years:

- Upland and riparian forested buffer areas should have 50% cover by forested species planted, or be supplemented or replaced by native naturally colonizing upland forested plant community at 50% or greater cover.

After five years:

- **Upland and riparian forested buffer areas should have 75% cover by forested buffer species planted, or be supplemented or replaced by native naturally colonizing upland forested plant community at 75% or greater cover.**

#### **Contingency Plans**

1. If the coverage of trees is less than 50 percent after the third growing season these species will be replanted. Sprigs, cuttings seeds or live plant material will be replanted and monitored to assure that coverage meets performance standard criteria. Remedial work may occur if hydrology is not sufficient to support wetland vegetation.

- 2. If areal coverage of wetland plants is less than 50 percent after the fourth year, resource agencies will be consulted for advice on further measures to remedy the problems at the site. The monitoring program will be extended and such reasonable measures will be performed as are necessary to establish appropriate wetland vegetation. WSDOT will perform all reasonable measures considered necessary to establish and maintain a functioning wetland system.**
- 3. The mitigation plan is designed to utilize and promote growth of native vegetation. Attempts will be made to limit the spread of exotic species and they will not be allowed to dominate the site. Noxious weeds, such as purple loosestrife will be eliminated immediately if found occurring on the site, before large populations can establish. A weed control program will be implemented if more than 10 percent of the wetland is invaded by invasive exotic species.**

## Appendix E

### SR 164 Bass Lake 2 Success Standards

The following excerpt is from the *Final Wetland Mitigation Report SR164 – SE 369<sup>th</sup> Place & 158<sup>th</sup> Avenue SE* (WSDOT 2003). Standards of success and contingency plans addressed this year are identified in **bold** font. Other standards have been addressed in the indicated monitoring year.

#### 5.6 SUCCESS STANDARDS

##### 5.6.1 Mitigation Goals

The Middle Green River wetland/floodplain complex provides important wetland and stream functions, and is a high quality system despite the surrounding levels of development. The Middle Green River wetland system provides significant wildlife, including habitat for migration/travel, escape, resting, forage, and reproduction.

While the Middle Green River system currently provides significant wildlife and fish habitat, the overall quality and quantity of functioning habitat could be improved using restoration and enhancement of degraded wetland and stream areas in that system. The proposed compensatory mitigation for this project is intended to replace wetland types and wetland functions that will be lost due to project construction. Proposed mitigation is anticipated to mitigate loss of the following functions:

- Wildlife habitat: mitigation will increase available habitat for wildlife and increase habitat and floodplain connectivity.
- Food chain support: mitigation will increase available wildlife forage material.
- Flood water attenuation: mitigation will increase the floodplain area.
- Nutrient/contaminant trapping: mitigation will provide an increased area of vegetated floodplain having opportunity to intercept and transform road-runoff contaminants, fertilizers, herbicides, and other pollutants from residential and agricultural activities upstream.

A combination of creation and enhancement activities will be used too obtain these benefits. Overall, these activities will attempt to achieve 0.2806 acres of palustrine forest wetland (created and enhanced), 0.1719 acre of scrub-shrub wetland, and 0.0435 acre of emergent wetland as mitigation for the loss of 0.2150 acre of palustrine forested, scrub-shrub and emergent wetland.



## **5.6.2 Objectives and Performance Standards**

### **Objective 1: Wetland Aerial Extent and Wetland Hydrology**

The wetland mitigation actions involving creation must demonstrate a total of 0.4176 acre, or more that support wetland hydrology. Hydrology in zones of creation will be monitored in Monitoring Years one, Three, and Five. Monitoring wells will be left in place to for the entire monitoring period to facilitate hydrologic data analysis and facilitate PS1.

#### **Performance Standards: Monitoring Years One through Ten**

**PS1. Creation and restoration areas must achieve 0.4568 acre or more area that has soils that are saturated to the surface, or has standing water present in a monitoring well at 12 inches below the surface or less, for a consecutive number of days greater than or equal to 10% of the growing season. Wetland hydrology will be determined using indicators of wetland hydrology, as listed in the *Washington State Wetlands Identification and Delineation Manual* (Ecology publication #96-94).**

#### **Monitoring/Delineation Schedule**

A determination of aerial extent will be made during the hydrology-monitoring period using standard wetland delineation methodology using these monitoring data. The boundary and aerial extent of the area supporting wetland hydrology will be determined using an instrument survey or other reliable method of determining area such as monitoring wells or hydrometers.

#### **Potential Contingency Actions**

1. Re-grade the site to achieve the required acreage supporting hydro periods that meet the hydrology criterion for wetlands (Environmental Laboratory 1987).

### **Objective 2: Vegetation**

The mitigation program is intended to enhance 0.0784 acre of existing scrub-shrub wetland to a forested habitat, and create 0.0435 acre of emergent wetland habitat, create 0.1719 acre of scrub-shrub wetland habitat, and create 0.2022 acre of forested wetland (Table 4). Each of these habitats are expected to be dominated by native plant species. Wetland plant communities are expected to appear to be succeeding toward the intended forested, scrub-shrub, and emergent communities.

#### **Performance standards: Monitoring Year One (one year after planting)**

**PS2. At the end of the first growing season all woody species shall be alive and healthy (all dead species will be replaced).**

### **Performance Standards: Monitoring Year Three**

**PS3.** Native emergent facultative or wetter vegetation will achieve 60% or more aerial cover involving at least three herbaceous plant species. Native woody species will achieve 15% or more aerial cover involving at least three species. Native colonizing vegetation will be included in these coverage calculations.

**PS4.** Native upland buffer woody species will achieve 15% or more aerial cover involving at least three woody plant species. Native colonizing vegetation will be included in this coverage calculation.

**PS5.** All King County-listed Class A, B-designate, and County-selected priority noxious weed species will be controlled in the season they are first identified on the mitigation site. Less than 10 percent aerial cover by these species will be maintained throughout the monitoring period including reed canarygrass (*Phalaris arundinacea*).

### **Performance Standards: Monitoring Year Five**

**PS6:** Five years after planting, emergent wetland mitigation areas will be comprised of a planted and native naturally colonizing plant community with 75% or more aerial cover involving at least three herbaceous plant species adapted for life in saturated soil conditions (facultative-wet or wetter). Forested wetland mitigation areas will be comprised of a planted and native naturally colonizing plant community with 25% or more aerial cover involving at least three species of woody plant species adapted for life in saturated soil conditions (facultative or wetter).

**PS7.** Five years after planting, the buffer will be comprised of a planted and native naturally colonizing plant community with 25% or more aerial cover involving at least three woody plant species.

### **Performance Standards: Monitoring Year Seven**

**PS8.** Seven years after planting, emergent wetland mitigation areas will be comprised of a planted and native naturally colonizing plant community with 75% or more aerial cover involving at least three herbaceous plant species adapted for life in saturated soil conditions (facultative-wet or wetter). Forested wetland mitigation areas will be comprised of a planted and native naturally colonizing plant community with 35% or more aerial cover involving at least three species of woody plant species adapted for life in saturated soil conditions (facultative or wetter).

**PS9.** Seven years after planting, the buffer will be comprised of a planted and native naturally colonizing plant community with 35% or more aerial cover involving at least three woody plant species.

## **Performance Standards: Monitoring Year Ten**

**PS10.** Ten years after planting, emergent wetland mitigation areas will be comprised of a planted and native naturally colonizing plant community with 75% or more aerial cover involving at least three herbaceous plant species adapted for life in saturated soil conditions (facultative-wet or wetter). Forested wetland mitigation areas will be comprised of a planted and native naturally colonizing plant community with 50% or more aerial cover involving at least three species of woody plant species adapted for life in saturated soil conditions (facultative or wetter).

**PS11.** Ten years after planting, the buffer will be comprised of a planted and native naturally colonizing plant community with 50% or more aerial cover involving at least three woody plant species.

## **Monitoring Schedule**

Once during the middle part of the growing season in Monitoring Years One, Three, and Five. Monitoring may occur in years if there is believed to be a potential problem on the site.

## **Potential Contingency Actions**

- 1. Before the beginning of Monitoring Year One, all dead or unhealthy woody species will be replaced. Thus, monitoring 100% survival in Monitoring Year One (Performance Standard PS3) will be verifying this.**
- 2. If the site does not meet performance standards PS3, PS4 and PS5 (Monitoring Year Three), additional planting will be conducted. Live, containerized plant material will be replanted and monitored to assure that coverage meets performance standards PS6 and PS7 (Monitoring Year Five).**
- 3. If the site does not meet performance standards PS5, PS6 and PS7 (Monitoring Year Five), resource agencies will be consulted for advice on further measures to remedy problems at the site. The monitoring schedule will be extended and such reasonable measures will be conducted as necessary to establish appropriate wetland vegetation. WSDOT will perform all reasonable measures considered necessary to establish and maintain a functioning wetland/buffer system that meeting the goals and objectives of this monitoring plan.**
- 4. The mitigation plan uses and promotes the growth of native vegetation. King County Class A, B-designate, and County-selected priority noxious weed species will be controlled in the season they are first identified on the site.**
- 5. If the site does not meet species diversity standards, additional species will be installed as necessary.**

## 5.7 MONITORING PLAN

The WSDOT Wetland Mitigation Monitoring Program (Monitoring Program) uses objective-based monitoring to document success and change in the WSDOT wetland mitigation sites. Monitoring protocols are based on specific objectives written in each project's wetland mitigation plan, combined with evaluation of current site conditions. A customized monitoring program is developed for each site. The Monitoring Program uses a variety of ecological monitoring techniques and protocols, including those outlined in WSDOT (2000). Many standard techniques such as permanent transect lines, plots, and photo points are still used. However, the number and placement of those depend on specific site objectives. Locations of photo points and transects, if used, are not selected until the first year of monitoring. Statistical precision and accuracy are used to determine the number and configuration of transects and sample plots.

After the planting plan has been constructed and planted, Monitoring Year One will commence at the start the first summer following plant installation. The Monitoring Program will monitor the mitigation site for at least ten years. Parameters to be monitored during the ten-year period include hydro period and vegetation, as described above.

Reports for the ten-year monitoring period (including a report for each of Monitoring Years One, Three, Five, Seven, and Ten), will be issued to the Corps of Engineers, Washington State Department of Ecology, King County Department of Development and Environmental Services, and other appropriate resource agencies for review and comment. Successful mitigation will be measured by attainment of the performance standards described in this mitigation plan document. Monitoring may be curtailed early or reduced in intensity if the mitigation effort meets the stated performance standards earlier than anticipated.

Wetlands are dynamic systems where plant communities evolve as conditions change. When changing conditions are driven by human activities such as excavation, grading, or modifying hydrology, the evolution of plant communities is difficult to predict. Because of this, wetland creation, restoration, and enhancement projects are challenging to monitor.

Static monitoring plans fail to account for dynamic change in the plant communities they are intended to measure. As a result, the Washington Department of Transportation (WSDOT) Monitoring Program uses the principles of adaptive management to guide monitoring activities.

Adaptive management is a process with two key components (Elzinga et al 1998). One component is that monitoring should only be initiated if opportunities for management change exist. The contingency plans in section 5.6.2 outline the opportunities for management change at the mitigation site.

The second component is that monitoring is driven by objectives. The objective describes the desired condition, and management activities are designed to meet the objective. In turn, monitoring activities are designed to determine if the objective has

been achieved. Valid monitoring data is critical to making meaningful management decisions that help the site meet its objectives. The objectives for this site are also contained in section 5.6.2.

Monitoring plans and our strategy for measuring success standards are based on site conditions and plant community development. These factors in addition to the performance objectives and success standards are incorporated into a site-specific monitoring plan at the beginning of each field season. Appropriate monitoring activities are used to ensure valid data is used to guide site management decisions.

## Appendix F

### SR 167 Mill Creek St. 2 Success Standards

#### GOALS, OBJECTIVES, AND PERFORMANCE STANDARDS

The following excerpt is from the *SR 167 15<sup>th</sup> St SW to South Grady Way Stage 2 Final Wetland Mitigation Plan* (Swanson 1995). The standards addressed this year are identified in **bold** font.

#### Goals

The primary goal of the wetland mitigation plan is to establish a self-sustaining, functional wetland system that will enhance water quality and wildlife habitat along the riparian corridor of Mill Creek and the Algona tributary. The restoration site is expected to undergo a transition from a grassland community to a scrub-shrub community and eventually to a structurally complex forested wetland. The restored wetland will provide the following wetland functions: wildlife habitat, food chain support for fish and wildlife, water storage and peak flow attenuation, and sediment and nutrient trapping.

#### Objective 1- Plant Communities

Create a wetland plant community with both vertical and horizontal structure and species diversity similar to that found in natural wetland system in the surrounding area.

#### Performance Standards

##### After 3 years:

- a. A scrub-shrub community will be established that is dominated (more than half) by species with wetland indicator status of FAC or FACW. Areal cover of the woody plants will be at least 10%.
- b. Areal cover by reed canarygrass shall not exceed 10%.

##### After 5 years:

- c. **The wetland will have at least 25% cover by woody vegetation dominated by FAC or FACW species.**
- d. **At least 90% of the woody vegetation (trees and shrubs) will be composed of native species.**
- e. Areal cover by reed canarygrass shall not exceed 10%.

#### Objective 2 – Wildlife Habitat

**Wildlife habitat for wetland dependent and other species will be improved by increasing both habitat diversity (the number of habitat types present) and habitat complexity (the number and spacing of vegetative layers and patches).**

The site will be designed to provide a mixture of habitat types at maturity, consisting of forest and scrub-shrub wetland, riparian stream, and upland buffer. **Perching, nesting and foraging opportunities for passerine birds will be provided in the scrub-shrub and forested area. Feeding and resting areas will be provided for a number of terrestrial wildlife in the wetland and upland buffer.**

### **Performance Standards**

#### **After 3 years:**

- a. Woody vegetation will be established in the wetland to replace the existing grassland community, as provided in Objective 1.
- b. The upland buffer area will have at least 10% cover by tree and shrub species.

#### **After 5 years:**

- c. **Upland buffer will have at least 25% cover by native trees and shrubs.**

### **Objective 3 – Algona Tributary Riparian Enhancement**

Riparian plantings along the Algona tributary will shade the creek providing the potential to moderate water temperatures and augment the aquatic food chain.

### **Performance Standards**

#### **After 3 years:**

- a. The wetland enhancement area along the tributary will have at least 10% cover by native trees and shrubs.

#### **After 5 years:**

- b. **The wetland enhancement area will have at least 25% areal cover by native trees and shrubs.**

### **CONTINGENCY PLANS**

Contingency plans will ultimately consist of replanting the site in case of planting failure or other unforeseen problems. In the event that areal coverage by native trees and shrubs falls short of the listed performance standards, additional measures will be employed to assure the establishment of a viable wetland plant community.

The following schedule summarizes how achievement of performance standards and mitigation goals will be assured:

- a. If the coverage by native shrubs and trees is less than 10% after the third growing season the site will be replanted. Sprigs, cuttings, seeds or live plant material will be replanted and monitored to assure that coverage meets performance standards by the end of the fifth year.

**b. If areal coverage of wetland plants is less than 50% after the fifth year, such as reasonable measures will be performed as are necessary to establish appropriate wetland vegetation and the monitoring program will be extended until the standards are met. WSDOT will perform all reasonable measures considered necessary to establish and maintain a functional wetland system.**

**c. The mitigation plan is designed to use and promote the growth of native vegetation. Attempts will be made limit the spread of exotic species, which will not be allowed to dominate the site. Noxious weeds (reed canary grass, non-native blackberries, Scot's broom) will be eliminated immediately if found occurring on the site, before large populations can establish. A weed control program will be implemented if more than 10% of the wetland is covered with invasive exotic species.**



## Appendix G

### SR 169 Bass Lake 1 Success Standards

The following excerpt is from *Wetland Mitigation Plan SR169: SE 400<sup>th</sup> St. Channelization and Signal* (Leonard and Sullivan 2002). Standards of success and contingency plans addressed this year are identified in **bold** font. Other standards have been addressed in the indicated monitoring year.

#### 5.6 SUCCESS STANDARDS

##### 5.6.1 Mitigation Goals

The Middle Green River wetland/floodplain complex provides important wetland and stream functions, and is a high quality system despite the surrounding levels of development. The Middle Green River wetland system provides significant wildlife habitat, including habitat for migration/travel, escape, resting, forage, and reproduction.

While the Middle Green River system currently provides significant wildlife and fish habitat, the overall quality and quantity of functioning habitat could be improved using restoration and enhancement of degraded wetland and stream areas in that system. The proposed compensatory mitigation for this project is intended to replace wetland types and wetland functions that will be lost due to project construction. Proposed mitigation is anticipated to mitigate loss of the following functions:

- Wildlife habitat: mitigation will increase available habitat for wildlife and increase habitat and floodplain connectivity.
- Food chain support: mitigation will increase available wildlife forage material.
- Flood water attenuation: mitigation will increase the floodplain area.
- Nutrient/contaminant trapping: mitigation will provide an increased area of vegetated floodplain having opportunity to intercept and transform road-runoff contaminants, fertilizers, herbicides, and other pollutants from residential and agricultural activities upstream.

A combination of creation and enhancement activities will be used to obtain these benefits. Overall, these activities will attempt to achieve 1.125 acres of palustrine forested wetland, 0.292 acres of scrub-shrub wetland, and 0.075 acre of emergent wetland as mitigation for the loss of 0.49 acre of palustrine scrub-shrub and emergent wetland.

##### 5.6.2 Objectives and Performance Standards

#### **Objective 1: Wetland Aerial Extent and Wetland Hydrology**

The wetland mitigation actions involving creation and restoration must demonstrate a total of 0.731 acres or more that support wetland hydrology (Table 3). Hydrology in zones of creation and restoration will be monitored in

Monitoring Years One, Three, and Five. Monitoring wells will be left in place to for the entire monitoring period to facilitate hydrologic data analysis and facilitate PS1.

Performance Standards: Monitoring Years One through Ten

**PS1. Creation and restoration areas must achieve 0.731 acres or more area that has inundation or saturation to within 12 inches of the surface for at least two weeks during the growing season (Table 3).**

Monitoring/Delineation Schedule

A determination of aerial extent will be made during the hydrology monitoring period using standard wetland delineation methodology using these monitoring data. The boundary and aerial extent of the area supporting wetland hydrology will be determined using an instrument survey or other reliable method of determining area such as monitoring wells or hydrometers. Delineate in years 5 and 10. (Per Terry Sullivan)

Potential Contingency Actions

1. Regrade the site to achieve the required acreage supporting hydroperiods that meet the hydrology criterion for wetlands (Environmental Laboratory 1987).

**Objective 2: Vegetation**

The mitigation program is intended to enhance 0.058 acre of scrub-shrub wetland (4 percent), enhance 0.703 acres of forested habitat (47 percent), create 0.075 acre of emergent wetland habitat (5 percent), create 0.234 acre of scrub-shrub wetland habitat (16 percent), and create 0.422 acre of forested wetland (28 percent) (Table 3). Each of these habitats will be dominated by native plant species. Wetland plant communities are expected to appear to be succeeding toward the intended forested, scrub-shrub, and emergent communities.

Performance Standards: Monitoring Year One (one year after planting)

**PS2. At the end of the first growing season all woody species shall be alive and healthy (all dead species will be replaced).**

Performance Standards: Monitoring Year Three

**PS3.** Three years after planting, emergent wetland mitigation areas will be comprised of a planted and native naturally colonizing plant community with 60% or more aerial cover involving at least three herbaceous plant species adapted for life in saturated soil conditions (facultative-wet or wetter). Forested wetland mitigation areas will be comprised of a planted and native naturally colonizing plant community with 15% or more aerial cover

involving at least three species of woody plant species adapted for life in saturated soil conditions (facultative or wetter).

**PS4.** Three years after planting, upland buffer zones will be comprised of a planted and native naturally colonizing plant community with 15% or more aerial cover involving at least three woody plant species.

**PS5. All King County-listed Class A, B-designate, and County-selected priority noxious weed species will be controlled in the season they are first identified on the mitigation site. Less than 10 percent aerial cover by these species will be maintained throughout the monitoring period. Reed canarygrass (a King County Weed of Concern) is expected to be present during the life of this mitigation effort due to the abundant and adjacent source of propagules, as well as the presence of reed canarygrass on the mitigation site. Thus, no performance standards are directed specifically at reed canarygrass. Rather, the abundance and vigor of stands of reed canarygrass that persist or re-establish on the mitigation site will be targeted by ensuring establishing woody plant communities are succeeding in directions that displace or weaken this species. Long-term management of reed canarygrass is expected to result from establishment of densely vegetated woody (forested) plant communities on the mitigation site. This should include planting woody species in the emergent areas as needed.**

#### Performance Standards: Monitoring Year Five

**PS6.** Five years after planting, emergent wetland mitigation areas will be comprised of a planted and native naturally colonizing plant community with 75% or more aerial cover involving at least three herbaceous plant species adapted for life in saturated soil conditions (facultative-wet or wetter). Forested wetland mitigation areas will be comprised of a planted and native naturally colonizing plant community with 25% or more aerial cover involving at least three species of woody plant species adapted for life in saturated soil conditions (facultative or wetter).

**PS7.** Five years after planting, the buffer will be comprised of a planted and native naturally colonizing plant community with 25% or more aerial cover involving at least three woody plant species.

#### Performance Standards: Monitoring Year 7

**PS8.** Seven years after planting, emergent wetland mitigation areas will be comprised of a planted and native naturally colonizing plant community with 75% or more aerial cover involving at least three herbaceous plant species adapted for life in saturated soil conditions (facultative-wet or wetter). Forested and scrub-shrub areas will be comprised of a planted and native natural colonizing plant community with 35% or more aerial cover involving at least three woody plant species adapted for life in saturated soil conditions (facultative or wetter).

**PS9.** Seven years after planting, the buffer will be comprised of a planted and native naturally colonizing plant community with 35% or more aerial cover involving at least three plant species.

Performance Standards: Monitoring Year 10

**PS10.** Ten years after planting, emergent wetland mitigation areas will be comprised of a planted and native naturally colonizing plant community with 75% or more aerial cover involving at least three herbaceous plant species adapted for life in saturated soil conditions (facultative-wet or wetter). Forested and scrub-shrub areas will be comprised of a planted and native naturally colonizing plant community with 50% or more aerial cover involving at least three species of woody plants adapted for life in saturated soil conditions (facultative or wetter).

**PS11.** Ten years after planting, the buffer will be comprised of a planted and native naturally colonizing plant community with 50% or more aerial cover involving at least three plant species.

**Monitoring Schedule**

Once during the middle part of the growing season in Monitoring Years One, Three, and Five. Monitoring may occur in other years if there is believed to be a potential problem on the site.

Potential Contingency Actions

- 1. Before the beginning of Monitoring Year One, all dead or unhealthy woody species will be replaced. Thus, monitoring 100% survival in Monitoring Year One (Performance Standard PS3) will be verifying this.**
2. If the site does not meet performance standards PS3, PS4 and PS5 (Monitoring Year Three), additional planting will be conducted. Live, containerized plant material will be replanted and monitored to assure that coverage meets performance standards PS6 and PS7 (Monitoring Year Five).
3. If the site does not meet performance standards PS5 (vegetation not succeeding in directions that displace or weaken reed canarygrass), and PS6 and PS7 (Monitoring Year Five), resource agencies will be consulted for advice on further measures to remedy problems at the site. The monitoring schedule will be extended and such reasonable measures will be conducted as necessary to establish appropriate wetland vegetation. WSDOT will perform all reasonable measures considered necessary to establish and maintain a functioning wetland/buffer system that meets the goals and objectives of this monitoring plan.

**4. The mitigation plan uses and promotes the growth of native vegetation. King County Class A, B-designate, and County-selected priority noxious weed species will be controlled in the season they are first identified on the site.**

## **CONTINGENCY ACTIONS**

WSDOT anticipates the mitigation goal will be achieved by accurately completing the grading and planting plans. However, contingency actions, as described above, may be needed to correct unforeseen problems. Such actions may consist of regrading the site in the case of insufficient hydroperiod, or replanting the site in the case of planting failure. However, natural recruitment of native wetland species and upland species (in the buffer) will be counted toward achieving performance standards for Vegetation. Should aerial coverage of wetland or buffer plants consistently fall short of desired performance standards, WSDOT will consult with appropriate agencies in determining what additional measures could be implemented to ensure establishment of viable wetland and upland plant communities.

### **Excerpt from King County Clearing/Grading Permit #L01CG431**

**5550- Permittee shall monitor the site for a period of five years to ensure survival of the plant material and control of non-native plant species.** At the end of five years, 80% of each species of the required vegetation must survive and no non-native plant species shall exist within the project area. Permittee shall submit monitoring reports on an annual basis.

## Appendix H

### SR 202 Rutherford Creek Permit Requirements

The following excerpt is from the *King County DDES Permit* (L01CG183). Permit requirements addressed this year are identified in **bold** font.

#### King County DDES Permit L01CG183

##### Sensitive Area conditions per PAUE L01SAX01

**6000: Wetland Mitigation Plan: The wetland mitigation plan prepared by WSDOT Northwest Region Environmental Office (January 15, 2001) will be followed with the following corrections/modifications/clarifications:**

**6001: Wetland Monitoring Program (5.6.2, Objective 2, Monitoring Methods): Prior to implementation of the mitigation planting plan, the location and orientation of monitoring transects must be identified and submitted to King County for approval.**

**6002: Wetland and buffer monitoring reports must contain Methods, Results, Analysis, and Recommendations sections.**

##### Analysis:

The following equation provides an estimate for aerial cover ( $\bar{y}$ ) of native FAC and wetter species at MP 18.8 Berm.

$$\bar{y} = \frac{1}{n}(y_1 + y_2 + \dots + y_n) = \frac{1}{n} \sum_{i=1}^n y_i$$

$n$  = sample size (number of sample units)  
 $\bar{y}$  = sample mean (estimated aerial cover)

$$\bar{y} = \frac{1}{27}(9.5) = 0.35 = 35\% \text{ aerial cover}$$

Raw data is available on request.

##### Recommendations:

Replanting is necessary to meet the 100% survival requirement (Permit Requirement 2).

##### **Reports must include description/data for:**

- (a) **Plant survival, vigor, and aerial coverage from every plant community (transect data);**
- (b) **Site hydrology, including extent of inundation, saturation, depth to groundwater, function of any hydrologic structures, inputs, outlets, etc.;**
- (c) **Slope conditions, site stability, any structures or special features;**
- (d) **Buffer conditions, e.g. surrounding land use, use by humans, wild and domestic creatures;**
- (e) **Observed wildlife, including amphibians, avians, and others;**

- (f) Soils, including texture, Munsell color, rooting and oxidized rhizospheres; (Years 1 and 5 only per Steve Shipe.) and
- (g) 4" x 6" color photographs taken from permanent photo-points.

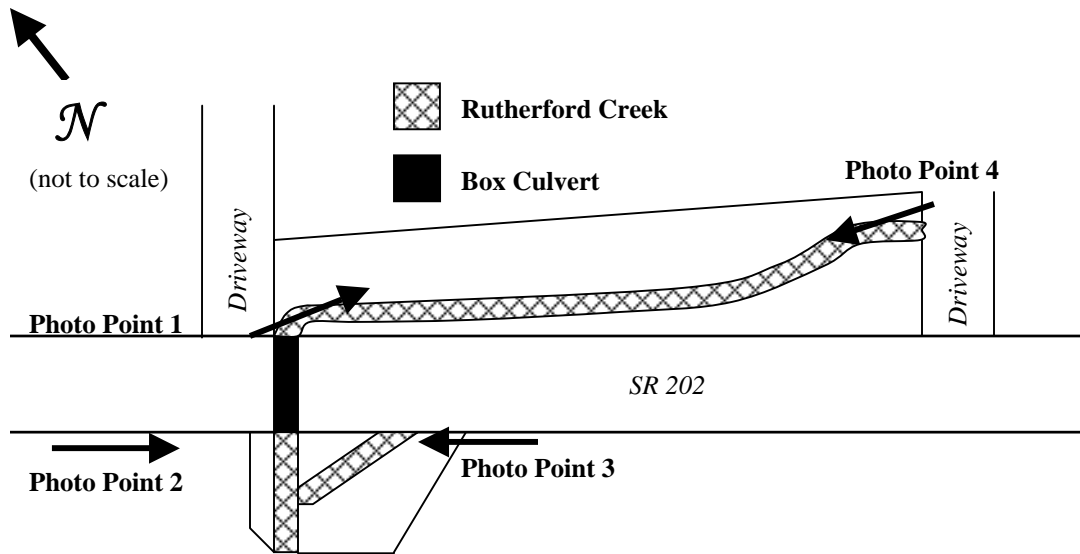


Figure 17.1 SR 202 Rutherford Creek Planting Area Photo Point Locations

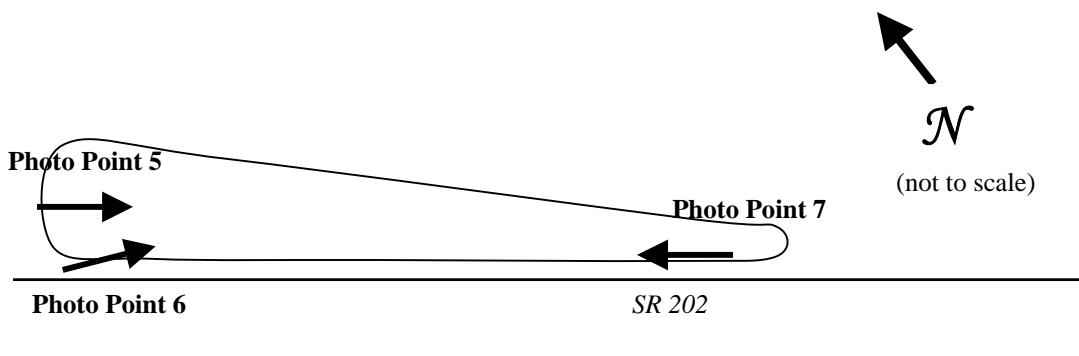


Figure 17.2 SR 202 MP 18.8 Berm Photo Point Locations





**Figure 17.3 Photo Point 1 at Rutherford Creek Planting Area**



**Figure 17.4 Photo Point 2 at Rutherford Creek Planting Area**





**Figure 17.5 Photo Point 3 at Rutherford Creek Planting Area**



**Figure 17.6 Photo Point 4 at Rutherford Creek Planting Area**





**Figure 17.7** Photo Point 5 at MP 18.8 Berm



**Figure 17.8** Photo Point 6 at MP 18.8 Berm



**Figure 17.9 Photo Point 7 at MP 18.8 Berm**

6003: Vegetative Success Standards for the restoration of 0.059 acre and enhancement of 0.0412 acre of wetland are described below (5.6.2, Objective 2, WSDOT January 15, 2001). Shrub and emergent survival and cover standards will be the same for wetland buffer plantings, however, native species in buffer areas need not be hydrophytic (FAC or wetter):

**6004: In year 1 achieve 100% survival of woody plant species and 60% aerial cover of native, facultative or wetter herbaceous plant species (where specified) in the wetland.** In year 3 achieve 85% survival of planted woody species, 60% aerial cover of native, facultative and wetter woody species, and 80% cover of native facultative or wetter herbaceous plant species. In year 5, achieve 85% aerial cover of native, facultative or wetter woody species and 90% cover of native, facultative or wetter herbaceous plant species in the wetland area. If vegetative success standards are not met, potential causes for poor vegetation establishment will be evaluated and correction measures will be implemented to assure compliance with the vegetative standards.

**6005: The 5-year monitoring period identified in the mitigation plan may be extended at DDES discretion if final inspection shows mitigation has not achieved performance standards, until such time as performance standards have been met.**

**6006: Should any monitoring report reveal that the mitigation has failed in whole or in part, and should that failure be beyond the scope of routine maintenance, the applicant must submit a Contingency Plan after consultation with King County and other appropriate agencies. This Plan may range in complexity from a list of plants**

**substituted, to cross-sections of proposed engineered structures. Once approved, it may be installed, and will replace the approved mitigation plan. If the failure is substantial, DDES will likely extend the monitoring period for that mitigation.**

**6007: Erosion Control: Any areas of exposed soils, including roadway embankments, that will not be disturbed for two days during the wet season (October 1 to March 31) or seven days during the dry season (April 1 to September 30) shall be immediately stabilized with approved TESC measures (e.g. seeding, mulching, plastic covering, etc.).**



## Appendix I

### SR 203 Stillwater Hill Road Success Standards

The following excerpt is from the *SR 203 Vicinity NE 77 Supplement #3 to Final Wetland Mitigation Plan* (WSDOT 2001). The criteria addressed this year are identified in **bold** font.

#### Mitigation Goals

The goals of the buffer enhancement are to improve ecological diversity by increasing the number of plants and plant species, and to ameliorate slope stabilization and water filtration with woody vegetation. As the more diverse plant communities mature so will the ecological diversity.

#### Standards of Success/Contingency Plan

##### Objective

Establish a variety of native, shrubs, and trees within the existing buffer areas. See “Buffer Enhancement Plan” plan sheets for locations.

##### Standards of Success

##### Monitoring Year 1, 2 and 3:

**Minimum 80% survival of planted species.**

##### Contingency

In the first year of plant establishment, all dead or unhealthy plants will be replaced. **In the second and third year of plant establishment, if over 20% of the plants are mortal then replanting of the mortal species will occur.**

##### Monitoring of Buffer Enhancement Areas

**The buffer enhancement areas will be monitored on years 1, 2 and 3 following the planting. Monitoring will include a count of plants to determine if plant survival percentages have been met.**

## Appendix J

### SR 5 Ash Way Goals and Objectives

The following excerpt is from the SR 5 Ash Way Park and Ride Wetland Mitigation Plan. (WSDOT 1997). The criteria addressed this year are identified in **bold** font.

#### Goals

The goal of the Ash Way Park and Ride wetland mitigation project is to replace wetland functions through creation of wetland and planting of native vegetation. The area of buffer impact will be replaced by the planting of native trees and shrubs. The impacted wetland is predominantly comprised of red alder, Douglas spiraea, salmon berry, and Himalayan blackberry. These are species common to areas of disturbance. The proposed mitigation plan will include planting a greater variety of species than those impacted. An increase in the number of species and vegetation strata will enhance plant and wildlife diversity. The addition of fruit-bearing shrubs will provide food and habitat for avians. Habitat structures should provide nesting and hiding area for small mammals. Water storage capacity that is lost will be replaced by the creation of the mitigation wetland.

#### Objectives

The following objectives and performance standards establish specific criteria that will be used by WSDOT to measure the mitigation site's success.

##### Objective1 – Vegetation

**The mitigation site will include 0.26 acres of forested wetland, 0.25 acres of scrub-shrub wetland, and 0.43 acres of upland buffer. The vegetation planted will provide value as food chain support and sediment and nutrient trapping as compared to existing site conditions. Water storage capacity will be increased.**

##### Objective 2 – Wildlife

**Wildlife habitat diversity will be increased by additions of native species plantings and from the combination of the establishment of early seral vegetation and climax vegetation. There will be at least twenty-seven habitat structures (logs, stumps with rootwads, and brush piles) within the boundary of the created wetland and its buffer. The addition of stumps, logs, and brush piles will increase habitat diversity and structure in the newly vegetation areas. Habitat structures (brush piles, stumps with rootwad, and log with rootwad) are located throughout the mitigation area to enhance edges of the existing and created wetland. Some are located mid-planting zone. The existing vegetation areas labeled “save and protect” contain significant amounts of downed material. The addition of fruit-bearing shrubs will provide food for avians and small mammals.**

### **Objective 3 – Buffers**

**There will be 0.43 acres of buffer surrounding the created wetland.**

#### **Contingency Plans**

**Mitigation goals will be accomplished with successful native vegetation plantings.**

The natural recruitment of native wetland species and upland species (to the buffer) throughout the mitigation site will assist any revegetation contingency plan. The contractor will be responsible for plant survival of plant materials for one-year period after initial planting acceptance.

**The mitigation plan is designed to utilize and promote the growth of native vegetation. During the first year of plant establishment a weed control program will be implemented if more than 10% of the wetland is invaded by invasive exotic species.**

## Appendix K

### SR 5 Stanwood Bryant Success Standards

The following excerpt is from the *SR 5 Stanwood/Bryant Vicinity Weigh Station Conceptual Wetland Mitigation Plan* (Ehinger and Tolon 1997). The standards addressed this year are identified in **bold** font.

#### Standard of Success

During the first year plant establishment, planted species that are dead or unsatisfactory shall be replaced. **Maintaining a weed-free condition and irrigation as necessary to ensure continued growth shall be accomplished.**



## Appendix L

### SR 9 Howell Creek Success Standards

The following excerpt is from the *SR 9 – SR 522 to Clearview Wetland Mitigation Plan* (WSDOT 1995). The performance criteria addressed this year are identified in **bold** font.

#### GOALS

The goal of this mitigation plan is to establish a Category II wetland with forested, scrub-shrub, and emergent vegetative classes that will provide high quality wildlife habitat. In general, it is expected that the combination of wetland enhancement and creation will function to provide fish and wildlife habitat, food chain support, water storage and flood attenuation, and sediment and nutrient trapping.

The overall quality of the wetland mitigation site will be increased by providing up to 75 foot forested buffer between the wetland and the surrounding developed areas. No buffer is necessary on the west or south border as they abut Little Bear Creek and an existing wetland, respectively.

#### OBJECTIVES AND PERFORMANCE STANDARDS

The following general objectives establish criteria that will be used by WSDOT and regulatory agencies to measure the success of the mitigation site. The objectives specify the direct actions necessary to achieve the stated goals. Specific criteria for performance standards will be used to determine success of the compensatory mitigation effort.

##### Objective 1 – Mitigation Site Vegetation

The mitigation site will provide vegetation structure and diversity similar to that found in the impacted wetlands. Specifically: 1) there will be an upland forested class established on the site; and 2) the wetland creation/enhancement area will contain forested, scrub-shrub, and emergent vegetation classes.

##### Performance Standards

After Three Years

- 1) Cover of woody species will be at least 30 percent in areas designed forested and scrub-shrub on Figure 3.
- 2) The scrub-shrub and forested wetland communities will have at least three facultative or wetter species.
- 3) Cover of emergent species will be at least 50 percent with predominantly facultative or wetter species.

#### **After Five Years**

- 1) **Cover of woody species will be at least 50 percent in areas designed forested and scrub-shrub on Figure 3.**
- 2) **Cover of emergent species will be at least 80 percent with predominantly facultative or wetter species.**
- 3) **Non-native species will comprise less than 15 percent of the wetland vegetation.**

#### **Objective 2 – Mitigation Site Wildlife Habitat**

Wildlife habitat will be developed by the establishment of forested, scrub-shrub, and emergent wetland classes.

#### **Performance Standards**

##### **After Three Years**

- 1) Performance standards from Objective 1 apply.

##### **After Five Years**

- 1) Performance standards from Objective 1 apply.
- 2) **A scrub-shrub vegetation class and forested vegetation class will be identifiable, as determined by the presence of species shown on the planting list and/or recruitment of native scrub-shrub or forest species.**

#### **Objective 3 – Stream Relocation and Enhancement**

Relocate the open channel of Howell Creek with an enhanced stream channel to include in-stream fish habitat structures.

#### **Performance Standards**

- 1) Vegetation performance standards from Objective 1 apply.
- 2) **In-stream habitat structures will remain in place at the end of the monitoring period.**
- 3) **At the conclusion of monitoring, the stream will provide juvenile rearing and overwintering habitat.**

#### **Objective 4 – Buffer Enhancement**

There will be 75 feet of forested/scrub-shrub buffer between the wetland mitigation site and both SR 9 and 233<sup>rd</sup> Place SE.

#### **Performance Standards**

See standards under Objective 1.

## **CONTINGENCY PLANS**

Mitigation goals should be accomplished with site grading and successful native plant establishment through planting. Contingency plans would ultimately consist of re-planting the site in case of planting failure or other unforeseen problems. The natural recruitment of native wetland and upland species throughout the mitigation site and buffer will assist any revegetation contingency plan.

## Appendix M

### SR 99 Lincoln and Manor Way Success Standards and Permit Requirement

The following excerpt is from the *Joint Wetland Mitigation Plan for SR 524: (196<sup>th</sup> St./Filbert Road) 24<sup>th</sup> to SR 527, SR 405: Bothell to Swamp Creek, Stage 2, SR 525: I-5 to SR 99 Widening, SR 525 Swamp Creek Park and Ride Extension, and SR 525: SR 99 Interchange* (WSDOT 1999). The criteria addressed this year are identified in **bold** font. Other tasks and standards will be addressed in the indicated monitoring year.

#### Goals

The goal of the proposed compensatory mitigation is to replace wetland types, acreage, and functions, which will be lost due to wetland impacts associated with the proposed projects. The proposed mitigation intends to create a total of 2.96 acres of wetland with plantings of native vegetation to achieve palustrine emergent, scrub-shrub, and forested vegetative classes as mitigation for the loss of 1,357 acres. A wetland buffer of 25 feet minimum is proposed at each site, creating 0.45 acres of buffer at Manor Way and 0.75 acres at Lincoln Way. The created wetlands are anticipated to provide the following functions and values:

- wildlife habitat – through increasing the available shrub and tree cover and habitat structures;
- flood attenuation – through increasing density of vegetative cover,
- contaminant buffering – by providing a well vegetated wetland area to intercept sediment and contaminants.

#### Objectives and Performance Standards

WSDOT will use the following objectives and performance standards as specific criteria to measure the mitigation site's success.

##### **Objective 1 - Hydrology**

The mitigation sites will provide ground or surface water inundation or saturation sufficient to support a long-term wetland site.

## **Performance Standards**

### **One thru Tenth-Year:**

- a. **Water is above, at or near the surface of the land for a minimum of 12.5 percent of the growing season (30 consecutive days from March through October.**

### **Fifth-Year**

- b. First through tenth year standard applies

### **Tenth-Year**

- c. First through tenth year standard applies.
- d. The wetland areas will be delineated using the current methodology to assure that the Manor Way site contains 1.29 acres of new wetland and the Lincoln Way site contains 1.67 acres of new wetland.

## **Objective 2 - Vegetation**

The compensatory mitigation sites will include a total of approximately 2.96 acres of emergent, forested, and scrub-shrub wetland vegetation and 1.20 acres of planted wetland buffer. The proposed Lincoln Way wetland will have an initial planting of 6% emergent, 30% scrub shrub, and 64% forest vegetation. Manor Way would have 22% emergent, 34% scrub-shrub, and 44% forested.

## **Performance Standards**

### **One-Year:**

- a. During the first year plant establishment, planted species that are dead or unsatisfactory shall be replaced. Maintaining a one-foot radius weed-free condition around each woody plant and irrigation as necessary to ensure continued growth shall be accomplished.

### **Third-Year:**

- b. **The emergent zones will have 70% relative areal coverage of facultative-wet or wetter native (i.e., excluding reed canarygrass or purple loosestrife) emergent vegetation, comprised of a minimum of three native species. The scrub-shrub and forested zones combined will have 15% areal cover by native facultative or wetter woody species, comprised of at least three species each.**
- c. **The buffer will have 15% areal coverage of native woody species.**

Fifth-Year:

- d. The emergent zones will have 75% or greater relative areal coverage of native facultative-wet or wetter species. The scrub-shrub and forested zones combined will have 25% areal cover by native facultative or wetter woody species, comprised of at least three species each.
- e. The buffer will have 35% areal cover of native woody species.

Tenth-Year:

- f. The wetlands maintain 75% areal coverage of native emergent species in the emergent zones. Areal cover of native woody species in the forested/scrub-shrub zone combined will be 50% and consist of facultative or wetter native species.

### **Objective 3 - Wildlife**

Wildlife cover and forage availability for birds and small mammals should increase substantially. The addition of fruit-bearing shrubs and stumps, logs, and brush piles will increase habitat diversity and structure in the newly vegetated areas. Overall, creating an emergent and scrub-shrub wetland is intended to provide feeding, breeding, and resting habitat for birds, small mammals, and amphibians.

### **Performance Standards**

First-Year:

- a. Habitat structures identified in the plans have been placed on the site.

Third-Year:

- b. Habitat structures identified in the plans are still in place.**
- c. After three years, increases in wildlife cover and forage species will improve habitat structure. This is expected to provide a corresponding increase in wildlife use.**
- d. Vegetation standards in Objective 2 apply.**

Fifth-Year:

- e. After five years wildlife cover and forage species will be established to where habitat structure will change from a single layer of vegetation to multiple layers.
- f. Vegetation standards in Objective 2 apply.

Tenth-Year:

- g. Vegetation standards in Objective 2 apply.

## Contingency Plans

Mitigation goals should be accomplished through successful completion of the planting plan. Contingency plans will ultimately consist of replanting the site in the case of planting failure or other unforeseen problems. The natural recruitment of native wetland species and upland species (to the buffer) throughout the mitigation site will assist any revegetation contingency plan.

In the event that the areal coverage of forest wetland or forested buffer plants falls short of the listed performance standards, additional measures will be employed to assure the establishment of these plant communities at the site(s). **In the event that by year three the hydrology standard is not met for 2.96 acres of the sites, agencies shall be consulted and remedial actions shall be employed to assure establishment of wetland hydrology at the site(s).**

The following schedule summarizes how we assure achievement of performance standards and mitigation goals:

**If the site does not meet the standards of success for vegetative cover after the third growing season, additional planting will be performed. Sprigs, cuttings, seeds or live plant material as necessary will be replanted and monitored to assure that coverage meets performance standard criteria. If required, remedial grading will occur if the hydrology standard is not met for two years of non-drought conditions.**

If the site does not meet the standards of success for vegetative cover after the fifth growing season, resource agencies will be consulted to discuss further measures to remedy the problems at the site. The monitoring program will be extended and remedial measures will be performed as necessary to establish appropriate wetland vegetation. WSDOT will perform all measures considered necessary to establish and maintain a functioning wetland system.

The mitigation plan is designed to utilize and promote the growth of native vegetation. Attempts will be made to limit the spread of exotic or noxious species and they will not be allowed to dominate the site. Noxious and invasive species identified in Snohomish County's Critical Area Regulation will be eliminated immediately if found occurring on the site, before large populations can establish. A weed control program will be implemented if more than 10% of the wetland is invaded by invasive exotic species (e.g., reed canarygrass or purple loosestrife).

## Operations And Maintenance

The goal of the wetland mitigation site is to create a functional self-sustaining system that should require very little maintenance. Once the vegetation establishes minimum disturbance will occur. WSDOT will retain the site in perpetuity. Maintenance will be performed by WSDOT personnel and would be confined to repairing vandalism, erosion damage, minor revegetation (if necessary), trash collection, and weed control.

## **Monitoring**

The site will be monitored by WSDOT for a minimum of ten years following mitigation construction and planning. Formal monitoring will be performed according to procedures outlined in WSDOT's Monitoring Methods (1996 Wetland Mitigation Monitoring Report) during the first, third, fifth, seventh and tenth year after planting. Informal monitoring will occur in the second, fourth, sixth, eighth and ninth years. Monitoring reports will be issued annually to the Corps of Engineers, Department of Ecology, Snohomish County and other resource agencies or local governments for review and comment. Successful mitigation will be measured by attainment of performance standards listed in the goals and objectives section of this document.

## **Permit Requirement**

The following excerpt is from the *WDFW HPA Permit* (00-D7276-02).

The monitoring program shall include inspection for stranded fish during seasons when the wetland is drying up, and at times of year when the water of the wetland approaches 70 degrees Fahrenheit. This monitoring shall be accomplished every year that plant monitoring is conducted. If fish are found to be stranded in wetland pools or other areas of the project at these times, wetland modification to solve the problem shall be proposed by WSDOT and accomplished under a separate HPA. Reports of monitoring for fish shall be forwarded to the appropriate WDFW biologist.



## Glossary of Terms

**Abundance (total)** – the total number of individuals, cover, frequency of occurrence, volume, or biomass of a species, or group of species, within a given area.

**Accuracy** – the closeness of a measured or computed value to its true value.

**Adaptive management** – the process of linking ecological management within a learning framework (Elzinga et al. 1998).

**Aerial cover** – is the percent of ground surface covered by vegetation of a particular species (or suite of species) when viewed from above (Elzinga et al. 1998). Values for aerial cover are typically obtained from point-line, point-frame, or line-intercept data.

**Areal estimates** – are made using the known boundary of a feature or statistical population. Areal estimates are often expressed in units of area.

**Aquatic vegetation** – includes submerged and rooted (*Elodea*, *Myriophyllum*) or floating (non-rooted) plants (*Lemna*, *Azolla*, *Wolffia*). For compliance purposes, these plants are not included in cover estimates. Vascular, rooted, floating-leaved plants *are* included in cover estimates (e.g., *Nuphar*, *Potamogeton*).

**Bare ground** – an area that can support, but does not presently support vascular vegetation.

**Canopy cover** – the coverage of foliage canopy (herbaceous or woody species) per unit ground area.

**Community** – a group of populations of species living together in a given place and time.

**Confidence interval (CI)** – is an estimate of precision around a sample mean. A confidence interval includes confidence level and confidence interval half-width.

**Cryptogam** – any of the *Cryptogamia*, an old primary division of plants comprising those without true flowers and seeds including ferns, mosses, and thallophytes (algae, fungi, and lichen).

**Density** – the number of plants per unit area (typically square meters).

**Densitometer** – a hollow T-shaped polyvinyl chloride (PVC) device that includes horizontal and vertical leveling and a mirror to locate a precise vertical point in space either directly above or directly below the densitometer. Target vegetation intersecting the vertical line of sight through the instrument is recorded.

**Herbaceous** – with characteristics of an herb; an annual, biennial, or perennial plant that is leaflike in color or texture, and not woody.

**Hydric soils** – soils formed under the conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (Federal Register 1994).

**Invasive** – a plant that interferes with management objectives on a specific site at a specific point in time (Whitson et al. 2001). For monitoring purposes, invasive species include those listed on the current County Noxious Weed List, and on a site-by-site basis, other species may be included (such as *Rubus armeniacus* (Himalayan blackberry)).

**Line-segment** – a linear sample unit that is used to measure vegetative cover.

**Macroplot** – usually refers to a relatively large sampling area in which sub-sampling will be conducted, often using quadrats, line-segments or point-lines (Elzinga et al. 1998).

**Open water** – an area intended to be non-vegetated and permanently inundated as described in the site mitigation or planting plan.

**Point-frame** – is a square or rectangular quadrat that consists of a set of identified points used to collect vegetation data.

**Point-Intercept Device** – a tripod that supports a rod that can be leveled and lowered vertically to intercept target vegetation at an identified point.

**Point-line** – linear series of points comprising a sample unit.

**Point-quadrat (points)** – a single point, used to sample vegetation data. The point quadrat is theoretically dimensionless.

**Population (biological)** – all individuals of one or more species within a specific area at a particular time.

**Population (statistical)** – the complete set of individual objects (sampling units) about which inferences are made.

**Precision** – the closeness of repeated measurements of the same value.

**Quadrat** – an area delimited for sampling flora or fauna; the sampling frame itself.

**Random sampling** – sampling units drawn randomly from the population of interest.

**Relative abundance (birds)** – the number of individuals per unit of sampling effort.

**Relative cover** – the relative cover of a plant species (or suite of species) is the proportion of the target species coverage compared to that of all species in the plant community combined (Brower et al. 1998).

**Restricted random sampling method** – a sampling method that divides the population of interest into equal-sized segments. In each segment, a single sampling unit is

randomly positioned. Sampling units are then analyzed as if they were part of a simple random sample (Elzinga et al. 1998).

**Sample** – a subset of the total possible number of sampling units in a statistical population.

**Sample size equations** – use sample mean and standard deviation to determine if data have been collected from enough sample units to meet the sampling objectives.

**Sample standard deviation** – a value indicating how similar each individual observation is to the sample mean.

**Sampling** – the act or process of selecting a part of something with the intent of showing the quality, style, or nature of the whole.

**Sampling objective** – a clearly articulated goal for the measurement of an ecological condition or change value (Elzinga et al. 1998). Sampling objectives provide a complement to success standards and describe the desired level of precision for sampling. Elements of a sampling objective include the desired confidence level and confidence interval half-width, or the acceptable false-change error and acceptable missed-change error level.

**Sampling units** – the individual objects that collectively make up a statistical population.

**Standard deviation** – a measure of how similar each individual observation is to the overall mean value.

**Shrub** – a woody plant which at maturity is usually less than six meters (20 feet) tall and generally exhibits several erect, spreading, or prostrate stems and has a bushy appearance (Cowardin et al. 1979). The species categories in this report follow Cooke (1997).

**Species richness** – the total number of species observed on a site.

**Structures** – any structure that is not expected to support vegetation during the monitoring period. Structures may include habitat structures, rocks, and other artifacts.

**Stratified random sampling method** – the population of interest is divided into two or more groups (strata) prior to sampling. Within each stratum the sample units are the same. Sample units from different strata may or may not be identical. Random samples are obtained within each group (Elzinga et al. 1998).

**Systematic random sampling method** – the regular placement of quadrats, points, or lines along a sampling transect following a random start.

**Transect** – for vegetation surveys, the transect is a line used to assist in the location sample units (point-lines, quadrats, line-segments or frames) across the monitoring study area.

**Tree** – a woody plant that at maturity is usually six meters (20 feet) or more in height and generally has a single trunk, unbranched for one meter or more above ground, and more or less definite crown (Cowardin et al. 1979). The species categories in this report follow Cooke (1997).

**Vegetation structure** – the physical or structural description of the plant community (e.g. the relative biomass in canopy layers), generally independent of particular species composition.

**Wetland-dependent species (birds)** – restricted in temporal or spatial distribution to wetlands based on an intrinsic feature or features of the environment (Finch 1989).

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